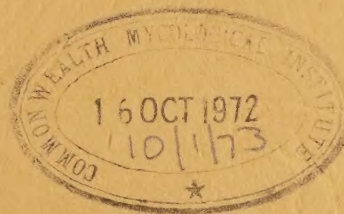
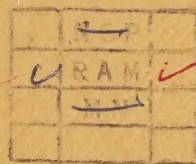




ANNUAL REPORT

1970-71



DEPARTMENT OF AGRICULTURE
NEW SOUTH WALES

1971
(SECOND SESSION)

PARLIAMENT OF NEW SOUTH WALES

REPORT
OF THE
DEPARTMENT OF AGRICULTURE
FOR THE
Year ended 30 June, 1971

Ordered to be printed, 2 December, 1971

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SENIOR ADMINISTRATIVE PERSONNEL*

AS AT 30TH JUNE, 1971

Minister	Hon. G. R. CRAWFORD, M.L.A.
Director-General	R. M. WATTS
Senior Deputy Director-General	Dr F. C. BUTLER
Deputy Director-General	B. OWEN FRENCH
Secretary	J. L. HAGER
Research Co-ordinator	K. E. HUTTON
Executive Officer (Agricultural Education)	J. E. JESSUP
Accountant	E. A. BRAGG
Chiefs of Divisions:	
Animal Industry Division	R. A. HALL
Dairy Division	Dr G. J. F. F. SMITH
Horticulture Division	G. R. GREGORY
Plant Industry Division	L. R. KAVANAGH
Marketing and Economics Division	P. C. DRUCE
Information Services Division	H. PARRY BROWN
Extension Services Division	B. D. AMENT
Research Stations Division	N. K. GOLDING
Principals, Major Agricultural Colleges:	
Hawkesbury Agricultural College	B. DOMAN
Wagga Wagga Agricultural College	B. F. ATKINS
Biological and Chemical Research Institute:	
Director	T. H. JOHNS
Royal Botanic Gardens and National Herbarium:	
Director and Chief Botanist	Dr J. S. BEARD

* For more detail of staff of the various divisions, branches, institutions, regions, etc., see the Department's brochure *Directory of Officers*. For staff numbers see *Appendix III* of this Report.

NEW SOUTH WALES

DEPARTMENT OF AGRICULTURE

Report of the Director-General to the Minister
for the year ended June 30, 1971.

Department of Agriculture,
SYDNEY.

2nd December, 1971.

Dear Sir,

Herewith the report of the Department of Agriculture for the 12 months ended June 30, 1971.

Yours faithfully,

R. M. WATTS,
Director-General.

CENTRAL ADMINISTRATION

THE SEASONS

TWELVE MONTHS SUMMARY

In retrospect the pastoral and agricultural situation in N.S.W. from July, 1970, to June, 1971, leaves the impression of a pendulum, swinging between extremes of shortage and abundance, as periods of drought alternated with excessive rains or floods.

Practically all divisions of the State at some time during the 12 months under review experienced some shortage of grazing for stock, with feed at other times good to abundant. Likewise, growers of all except a few irrigation-based crops underwent periods of frustration and anxiety, either at sowing or harvesting times, or both. Floods were an unfortunate feature of the period; they were widespread in September and December, 1970, and in the first 3 months of 1971.

Rabbits were reduced by myxomatosis but soon began breeding again. Lush feed and abundant surface water resulted in much trouble from blowflies and hordes of mosquitoes following the floods.

Altogether it was a year to vindicate the reputation of this country as one alternating rapidly between feast or famine conditions.

MONTH BY MONTH

At the beginning of July, 1970, pastures were dry and seriously deficient in bulk in northern inland areas and on the coast from Sydney to the Queensland border. Elsewhere, the feed situation was fair to good. The latter part of the winter of 1970 remained hard and dry. Heavy frosts extended inland further to the north and west than usual; coastal areas did not escape and moderate to severe frosts were reported at times down to sea-level. Extremely dry weather persisted, except in the south-eastern quarter of the State, until late in August. Extensive snowfalls occurred on the Highlands prior to the general light but useful rains in the fourth week of that month (the best for four months) after which the previously poor moisture situation was reversed.

At the beginning of September paddock feed and also stock water supplies were seriously to critically short in all northern areas, with new growth still too short to give any relief.

Snow was heavy on the Central Tablelands in early September just before moderate to heavy general rain began to cover the State, missing only a few small areas. The real break in the drought, however, was delayed until later that month when deep rain depressions brought flood-making falls to the northern border region, and also to the Tumut, Murrumbidgee and Murray Rivers. South coastal areas had good late September rain but falls remained much lighter on the Hunter and the North Coast.

Drier weather was welcome in most areas during October but useful storm rains in the Upper Western Division relieved acute water shortages on many holdings. Spring-temperatures were moderate and prolific growth of pastures, lucerne and crops ensured adequate summer feed in all except the moisture-deficient Hunter Valley and North Coast areas. Further heavy rain, beginning about mid-November and continuing into December, seriously disrupted the wheat harvest and again caused widespread and prolonged flooding of the Macintyre and other northern inland rivers. Water shortages on the North Coast were at last relieved. Pasture growth easily outstripped grazing in many districts during December. Pastures stayed green longer than usual and although a great deal of hay and silage was made, much of it was spoilt by the rain.

There were some dry days in early January but very humid conditions returned with further excessive rains at the month's end. Very serious floods again occurred in all northern inland rivers and also in the Hunter River and its tributaries. Worse was to follow as excessive rains continued during the first two weeks of February maintaining high river levels and inundating thousands of square miles of northern and central crop and pasture land. Tremendous damage was caused to roads and property improvements and water swept into several towns, rising to record heights.

Torrential falls of 20 inches or more occurred on the lower South Coast at the same time bringing a shortlived but disastrous flood to the Bega Valley.

The month of February, 1971, will certainly be long remembered because of these widespread and disastrous floods. Water lay for weeks on land inundated in the north and crop harvesting operations were suspended. Floodwaters continued to move down the Darling for many weeks, being followed by prolific growth of grasses and herbage.

It was therefore almost incredible that before the end of March many inland areas, including some of those previously flooded, were already in need of further rain to enable farmers to plough the hard-dried surface to prepare crop fallows. The Upper Western Division received heavy rain in March, in some places the heaviest for 15 years, and a lighter follow-up at the end of the month assured this region of ample feed for the autumn-winter period. Southern inland districts experienced generally favourable conditions throughout and the autumn stock feed position was good in all parts of the State apart from seriously flood-affected areas, where relief fodder supplies, for a time, had to be airlifted.

Dry and fine, settled weather with mild temperatures in April and May completed an almost rainless autumn in northern N.S.W. To the south, rainfall was light but sufficient to allow cultivation to continue. June continued the dry pattern, though colder, being broken only by an isolated period of heavy rain which did not extend far inland but was very useful on the Hunter and North Coast areas.

The prolonged lack of moisture resulted in a steady deterioration in pastures over these months and also a reduction in the amount of reasonable-quality paddock feed. The most favoured areas were parts of the coast and the Far West, especially to the north. Elsewhere, there was little new growth of either native or improved species, while age or weathering had left little nutriment in the carryover of tall, dry summer grasses.

As the period closed the pastoral outlook overall was not encouraging and general rains were urgently needed to improve late winter and spring prospects.

Declarations of whole or part Pastures Protection Districts as drought areas increased from fourteen in July, 1970, to a peak of thirty-two for the month of September. Improved spring conditions brought about a rapid reduction, until in January only two complete and three part districts were declared. By May, 1971, the Wentworth District in the far south-west was the sole declared area but by the end of June the number of districts had increased to four.

LIVESTOCK CONDITIONS

There was a marked swing to various forms of cattle raising enterprises throughout the past 12 months. Consequently, a strong demand was maintained for all types of re-stocker cattle at relatively high prices. Good types of breeding stock were most in demand.

Most dry sheep held condition fairly well under the harsh, dry conditions of the winter of 1970, but losses of lambing ewes from nutritional troubles were common and quite extensive, especially in northern parts of the State. Lamb survival rates were poor where feed was seriously deficient in northern and far western areas. Because of poor economic returns, hand feeding of sheep was kept to a minimum on most holdings. Condition of sheep generally improved over the spring and summer period, and good supplies of prime sheep and lambs were available for slaughter by the autumn.

The season to some extent favoured cattle rather than sheep with abundant summer growth being of more use to large stock, when supplemented with high protein concentrates. Apart from this factor, supplementary feeding was much more widespread and cattle were generally given more care and attention. Dairy stock in coastal areas, even more so than usual, had to be heavily supplemented at times to maintain production, and aged cows after calving in some cases were struggling to maintain reasonable condition.

COMMODITY PRODUCTION

Rain in August, 1970, relieved the situation for winter cereal crops but it was too late to recover all the ground lost. Wet weather at harvest affected most cereal crops. The dry autumn-early winter and the rain at harvest both affected wheat more than the other winter cereals.

Output of many crops reached high and, in some cases, record levels. Only in a few cases, notably wool and cotton, was there a considerable fall in production.

However, the lack of rain in the autumn-early winter of 1971 foreshadowed a likely repeat of the 1970 sowing conditions for winter cereal crops.

CEREALS

Wheat - Rain, Too Little and Then Too Much, Reduced Output

Production from the 1970-71 wheat crop has been provisionally estimated at 111,000,000 bushels from a sown area of almost 5,500,000 acres at an average yield of 20.2 bushels per acre. (Source: Bureau of Census and Statistics).

A dry autumn and early winter forced a reduction in intended sowings which, in any case, were expected to be lower than in the previous year due to the reduction in wheat delivery quotas. In 1970-71 delivery quotas were reduced from the 1969-70 level of 123,000,000 bushels plus an extra 7,000,000 bushels for prime hard wheat, to 99,000,000 bushels plus an extra 12,000,000 bushels for prime hard wheat.

Then heavy rains at harvest time reduced potential production considerably. The harvest was only two-thirds of the 163,000,000 bushels harvested in 1969-70.

For the new season's crop, land preparation and sowing were hindered seriously by the dry 1971 autumn and early winter, a repetition of the 1970 situation. Wheat delivery quotas were increased to 114,000,000 bushel plus 12,000,000 bushels for prime hard wheat and 2,000,000 bushels for durum wheat.

By the end of June, 1971, nearly all southern sowings were completed but only about half the central plantings and very little of the intended northern acreage had been sown. It was almost certain that northern farmers would not be able to sow all their intended acreage. Rain was needed urgently.

The Department's preliminary estimate for the total area to be sown to wheat in 1971 was 6,100,000 acres. Though this would be greater than the previous year's acreage, it would be less than the area farmers had originally intended to sow.

Oats - A Heavy Crop

About 1,920,000 acres were sown to oats for all purposes in 1970, of which about 1,000,000 acres were sown for grain. Dry weather affected sowing but most of the crop was taken off before the heavy summer rains.

Production was approximately 25,000,000 bushels, an average yield of 25 bushels per acre. This was the fourth biggest crop on record. (Source: Bureau of Census and Statistics).

A poll is scheduled for October to decide on a proposal to establish an oats marketing board in N.S.W.

Sowing of the 1971 oat crop was affected by dry weather. The Department's preliminary estimate is that 1,200,000 acres was sown. The unsatisfactory market prospects for oats compared to those for other major cereals and the unfavourable season were responsible for the reduced acreage.

Barley – Record Acreage and Production

The area sown to barley for grain was estimated at about 744,000 acres, the highest ever. Production was estimated at a record 18,900,000 bushels and the yield at 25.5 bushels per acre. (Source: Bureau of Census and Statistics).

As with wheat and oats, sowings of barley in 1970 were affected by the dry weather early in the season but the wet summer did not reduce production seriously.

A poll is to be held in August, 1971, to determine whether a barley marketing board is to be established in this state.

The 1971 barley sowings were also affected by the adverse conditions in autumn and early winter and the total area to be sown has been estimated at 800,000 acres – slightly less than the 830,000 acres sown in 1970 and certainly less than the area that farmers intended to sow.

Maize – Higher Production

Harvesting of the 1970–71 maize crop was virtually finished by the end of June.

It is probable that about 85,000 acres were sown for grain. Production was approximately 4,700,000 bushels, the highest output since the 1912–13 season. (Source: Department of Agriculture).

The wet summer and early autumn seriously affected maize crops on the Northern Tablelands while floods on the coast and in some inland areas also caused losses and reduced yields of standing crops. Fortunately, harvesting weather was more favourable and many inland and tablelands crops recovered.

As was the case last season, a small quantity, mostly from inland crops, was expected to be sold overseas. The greater part of the coastal crops was retained on local farms.

Grain Sorghum – Record Production and Expanding Exports

At the end of June, only a few grain sorghum crops remained to be harvested and to complete the best-ever harvest for this crop in N.S.W. Yields were mostly above average and the quality of grain was good.

A combination of excellent summer rains and a favourable, dry harvesting period in autumn resulted in a record output, estimated at near 18,000,000 bushels. Flood losses were less than expected as most crops recovered very well. Production was more than three times greater than in the previous season. The area sown was estimated at about 450,000 acres, about 200,000 acres more than in 1969–70. (Source: Department of Agriculture).

Possibly up to 14,000,000 bushels of the crop could be exported. By the end of June, about 12,000,000 bushels had already been delivered to the Grain Elevators Board with the rest to follow in the next few weeks. About one-third of receivals had been shipped by early July, 1971.

The State's newly established Grain Sorghum Marketing Board met for the first time in June, 1971. The Board decided not to handle the remainder of the 1971 harvest.

Rice – Lower Acreage but Record Production

Rice acreage fell slightly to 95,315 acres, compared with 96,800 acres in 1969–70. Production of rice, at 283,844 tons, was the highest ever and the average yield was a record of 2.98 tons per acre (at 14 per cent moisture content). Calrose production was 178,130 tons, Kulu 73,154 tons and Caloro 32,383 tons, the small remainder being made up of mixed grain. (Source: Bureau of Census and Statistics).

FIBRE AND OIL CROPS AND TOBACCO

Cotton – Record Acreage but Lower Production

The area under cotton rose from 56,660 acres to a record 65,240 acres in 1970–71 but the crop was hard hit by the February floods, especially in the Namoi Valley, and production slumped to 58,000 bales compared with 92,550 bales in 1969–70. (Source: Department of Agriculture).

Tobacco – Acreage and Production Both Increased

Tobacco acreage rose from 2,740 acres in 1969–70 to 3,040 acres in 1970–71 but was well below the record 3,400 acres in 1960–61. Production of quota leaf was estimated at 2,764,320 lb at an average yield of 909 lb per planted acre. A small quantity of non-quota leaf and burley tobacco was also produced. (Source: N.S.W. Tobacco Leaf Marketing Board).

Production was about 10 per cent lower than in 1969–70 and 383,000 lb below the state's quota of 3,148,000 lb.

Soybeans – Fall in Acreage and Production

Soybean acreage fell from 9,000 acres in 1969–70 (estimate by Department) to 6,330 acres in 1970–71. Though the difficulties experienced last year did not return, floods considerably reduced the area harvested and production was only about 2,740 tons. (Source: Bureau of Census and Statistics).

Linseed – Record Acreage and Production

Linseed sowings, at 50,750 acres, were a new record and slightly above the previous record of 50,372 acres in 1969–70. Production rose to 16,917 tons compared with the revised figure of 14,500 tons for 1969–70. (Source: Bureau of Census and Statistics).

Safflower – Record Acreage and Production

The safflower acreage increased sharply from 16,000 acres last season to a record 49,000 acres in 1970–71. The expansion was encouraged by the continuance of wheat delivery quotas, adequate soil moisture and favourable yields from the previous year's crops. Production, at a record 8,160 tons, reflected the large increase in acreage. (Source: Bureau of Census and Statistics).

Sunflower – Further Dramatic Increase in Acreage and Output

The area under sunflowers soared to a new, record level. The area was estimated at 212,000 acres in 1970–71, compared with an estimate of some 37,000 acres for the previous season. A fair quantity was lost because of the floods but output was naturally a new record, estimated at about 65,000 tons. (Source: Department of Agriculture).

The large increase in acreage of sunflowers was due mainly to good late winter rains in the northern districts and to farmers deciding to plant this crop rather than risk a very late wheat sowing. In the coming season, the area sown may be triple the 1970–71 area if farmers' intentions are realised.

Oilseed Rape – New Records

New records were set for oilseed rape in 1970–71 following the first commercial production in N.S.W. in the previous season. The area sown was estimated as 58,000 acres and production as approximately 20,000 tons. (Source: Department of Agriculture).

Sowings in the coming season are confidently expected to be near 100,000 acres.

FRUIT AND ALLIED INDUSTRY

The estimates of production of fruit crops have been made by the Department.

Citrus Fruits – Production Higher

The final estimate of 1970–71 citrus production was 7,710,000 bushels (7,500,000 bushels of main crop, 160,000 bushels of summer crop lemons and 50,000 bushels of second crop Valencias). This estimate was 690,000 bushels more than in the previous year.

Pome-Fruits – Apple Production a Record

The 1970–71 apple crop was a record. It was estimated at slightly more than 5,000,000 bushels, exceeding the 1969–70 crop by 1,200,000 bushels.

At an estimated 700,000 bushels, the pear crop was 200,000 bushels less than the previous year's record.

Only slightly more than half the apple crop and half the pear crop was "Fancy" grade. Hail damage was the main reason for downgrading.

Stone Fruits – High Yields

Peaches and apricots for canning. – The canning peach crop was a record 25,473 tons at an average yield of 8.1 tons per acre. The previous best crop was 21,284 tons in 1966–67. The apricot crop was 6,769 tons and the yield was high at 6.2 tons per acre. Apricot production exceeded cannery requirements.

Prunes. – The estimate of the state prune crop was 3,800 tons, about 200 tons less than the 1969–70 crop.

Banana Production Slightly Higher

At an estimated 3,950,000 bushels, banana production was slightly higher than in the previous year but still far below the record production of 1967–68. The acreage declined.

Wine Grapes and Wine Production

The quantity of grapes processed by wineries was estimated at 53,000 tons – much less than the record 70,981 tons of the previous year. The decline in production was largely due to the light crop on the Murrumbidgee and Coleambally Irrigation Areas when average yields fell from 8.9 tons per acre in 1969–70 to 5.9 tons per acre in 1970–71. The Hunter Valley crop was affected by torrential rain in mid-summer.

Dried Vine Fruits – Production Lower

Dried vine fruit production in 1970–71 was estimated at 9,031 tons dried weight (7,365 tons of sultanas, 1,064 tons of raisins and 602 tons of currants) – much lower than the record crop of 14,769 tons in 1969–70. Production of raisins and currants was well above normal but sultana production was severely reduced by low crop potential after the heavy crop of the previous season and berry splitting and mildew development.

MEAT PRODUCTION – INCREASE IN ALL TYPES

The following preliminary figures for the 1970–71 season (supplied by the Commonwealth Bureau of Census and Statistics) show a record production of mutton and lamb, pigmeats and poultry. Beef and veal production slightly exceeded the 1969–70 levels.

Beef and Veal – Increased Output

Production of 263,100 tons of beef was approximately 1,850 tons greater than the 1969–70 tonnage, but fell short of the 1964–65 record by almost 17,200 tons. Veal production, totalling 12,565 tons, was only a slight increase of 460 tons over the rather low figure of the previous year.

Mutton and Lamb – New Production Record

The 252,259 tons of mutton and lamb produced in 1970–71 exceeded the previous year's record of 233,501 tons by approximately 18,750 tons. Mutton output was 122,758 tons and lamb 129,501 tons.

Pigmeats (including Bacon and Ham) – New Gross Weight Record

A new record for carcass weight production of pigmeats was attained in 1970–71. The total of 49,352 tons (including meat later converted to bacon and ham) was an increase of 320 tons over the record figure of the previous year. Bacon and ham output, at 18,536 tons, was 2,584 tons higher than in 1970–71 and second only to the record 20,148 tons produced in 1944–45.

Poultry Meats – Tremendous Lift in Output

Production of poultry meats expanded even more rapidly than in the previous year. The new record output of 72,773 tons was 14,776 tons greater than that of 1969–70, representing an increase of 25 per cent.

Hatchings of meat-chickens rose sharply to 55,437,000 (comprising 54,462,000 from meat-strains and 975,000 from egg-strains) compared with 43,310,000 (41,464,000 from meat-strains and 1,846,000 from egg-strains) in 1970–71. Hatchings of pullets for egg production were 6,325,000. This was 785,000 less than in the previous year and very close to the total in 1968–69.

There was a further increase of approximately 152,000 in the number of turkey poultts hatched.

DAIRY PRODUCTION LOWER

Production of dairy products fell in 1970-71. Factory butter output was only 20,952 tons, as against 28,518 tons in 1969-70, while factory cheese output declined to 5,845 tons from the record level of 6,554 tons attained in the previous season. (Source: Commonwealth Dairy Produce Equalisation Committee Ltd).

The intake of milk by agent factories in the areas where the Dairy Industry Authority has assumed direct control of production and marketing fell from 160,070,000 gallons in 1969-70 to 152,320,000 gallons in 1970-71. (Source: Dairy Industry Authority).

EGGS - A RECORD

For the seventh successive season, commercial egg production reached a new record level. Output was 89,641,000 dozen compared with 82,020,000 dozen in 1969-70. (Source: N.S.W. Egg Marketing Board).

WOOL DELIVERIES

First-hand deliveries from the 1970-71 wool clip into the three main woolbroker centres at Sydney, Newcastle and Goulburn, totalled 1,354,874 bales, compared with 1,536,421 bales in 1969-70.

Total receivals, including carryovers from the previous season and wool received for re-sale, were 1,447,094 bales of which 1,370,930 bales were sold. Total receivals in the previous year were 1,635,704 bales of which 1,585,218 bales were sold.

Excluding 448 bales shipped abroad for sale, 75,716 bales were held in store unsold at the end of June, 1970. (Source: National Council of Wool Selling Brokers).

STOCK NUMBERS

Preliminary estimates of livestock numbers at March 31, 1971, (obtained from the Bureau of Census and Statistics) were as follows.

Sheep and Lambs - Slight Fall

The number of sheep and lambs was estimated at 71,100,000 - a decline of 1,183,500 from the March, 1970, total of 72,283,500. The 1970 total was the second highest ever achieved. It had been exceeded only by the record pre-drought figure of 72,396,000 in March, 1965.

Cattle - Record Total

The estimated number of cattle, both beef and dairy, was 6,493,700, exceeding by far the previous record of 5,637,000 in March, 1970. Beef cattle numbers jumped from 4,809,200 to 5,730,500 but the dairy cattle population continued to decline, falling from 827,838 in 1970 to 763,200 by March, 1971.

Pigs - Record Numbers

The pig population reached a new, record-level of 796,200 and substantially exceeded the previous record of 707,800 in March, 1970.

REPRESENTATION IN THE N.S.W. TRADE MISSION TO EUROPE, 1971

Dr F. C. Butler, Senior Deputy Director-General, accompanied the N.S.W. Trade Mission to Europe in the role of Agricultural Adviser and Consultant. The Mission successfully sought new outlets for locally manufactured goods and rural products, and explored opportunities for reciprocal licensing and joint manufacturing arrangements. Dr Butler is the first representative of the Department of Agriculture to participate in an overseas trade mission sponsored by the state government. His contributions to the success of the 1971 Mission to Europe were highly commended by the Mission Leader, The Hon. J. B. M. Fuller, M.L.C.

COUNCILS, COMMITTEES AND TRUSTS

AUSTRALIAN AGRICULTURAL COUNCIL AND STANDING COMMITTEE ON AGRICULTURE

Delegations from the Department attended meetings of the Australian Agricultural Council held at Mount Hagen, in the Territory of Papua and New Guinea, Canberra and Melbourne during the year. The Mount Hagen and Melbourne meetings were preceded by sessions of the Standing Committee on Agriculture. The Canberra meeting of Council in October, 1970, was specially convened to discuss wool marketing proposals.

FARRER MEMORIAL TRUST

Many matters concerning the activities of the Farrer Memorial Trust were dealt with by correspondence during the year and, as a result, it was only necessary to convene an annual meeting and one ordinary meeting.

The 1970 Farrer Memorial Medal was presented to Dr J. Melville, Director of the Waite Agricultural Research Institute at a ceremony held in the Great Hall of the University of Sydney on September 17, 1970. Afterwards, Dr Melville delivered the Oration titled "The Agricultural Dilemma". The Oration was organised in conjunction with the N.S.W. Branch of the Australian Institute of Agricultural Science.

Mr Eric E. Bond, Director of the Bread Research Institute of Australia, accepted the invitation of Trustees to be the 1971 Farrer Memorial Medallist and arrangements are in hand for a presentation ceremony later in the year.

Some re-organization of the Trust's investments was undertaken with the objective of increasing income to enable more frequent award of the Farrer Memorial Research Scholarship. Although no Scholarship was awarded in 1970-71, a complete review was commenced on the terms and conditions of the award to bring it into line with others currently available.

At December 31, 1970, the funds held by the Trust amounted to \$33,269.33, comprising investments in authorised securities of \$32,420 and \$849.33 cash at bank.

ROYAL BOTANIC GARDENS AND GOVERNMENT DOMAIN TRUST

The Royal Botanic Gardens and Government Domain Trust held four formal meetings to decide matters of policy concerning the area vested in Trustees. Some of the more important items discussed included: matters associated with the Eastern Suburbs railway project; leasing of refreshment kiosks; provision of car parking in the vicinity of the Sydney Opera House; a proposal for a high-rise tower and herbarium; a proposal for a music shell; revision of regulations; a suggestion for establishment of a Japanese garden; matters connected with the Sydney City Council's Strategic Plan for the City of Sydney.

Following the retirement of the former Director and Chief Botanist from the Department, arrangements were made for him to continue as a Trustee until a short time after his successor took up office. The composition of the Trust was temporarily increased from four to five during this period.

RETIREMENT OF A SENIOR OFFICER

Mr W. J. B. Murphy (Principal Livestock Officer, Beef Cattle) retired. Mr Murphy joined the Department in 1926 as a veterinary trainee. He served as a Veterinary Officer at head office, Kyogle and Hawkesbury Agricultural College and as Acting District Veterinary Officer, Cootamundra. In 1941 he joined the 2nd A.I.F.

On discharge from the army Mr Murphy was appointed Assistant Herdmaster and subsequently Principal Livestock Officer (Beef Cattle, Horses and Goats). He was closely associated with the Department's Arab horse stud which he later built into the premier Arab stud in Australia. In 1955 he was a member of an overseas stud stock buying delegation led by the Minister for Agriculture.

Mr Murphy initiated the scheme in which junior officers in the beef cattle section have a period of training on cattle properties in Queensland or the Northern Territory.

ORGANISATIONAL CHANGES AND DEVELOPMENTS

DIVISION OF MARKETING AND ECONOMICS

The title of the Division of Marketing and Agricultural Economics was changed to the Division of Marketing and Economics.

EMPHASIS ON FARM ADJUSTMENT

The Department endeavoured to assist farmers meet the difficulties resulting from lower prices for some products, especially wool, the necessity for wheat production quotas and the continued rise in costs of labour and materials used by farmers.

Extension officers assisted farmers to assemble information needed to decide about alternative enterprises, such as oilseed crops and beef production. They also advised on production methods for the new enterprises. Farmers and extension officers were assisted by information on the various adjustment possibilities provided by the regional economists.

Research programmes were reviewed to increase the flow of applied research results that would assist farmers and extension officers to formulate management strategies to meet changing market demands.

While the Department was not responsible for administering legislation dealing with farm adjustment and reconstruction, its officers advised farm people on technical and economic aspects of adjustment. In addition, the Department made the specialist knowledge and experience of its officers available to other Departments concerned with rural adjustment. An inter-departmental seminar on farm reconstruction was organised through the Division of Marketing and Economics and arrangements were begun with other state authorities to review the state services concerned with various aspects of rural adjustment and decentralisation.

THE AUSTRALIAN INOCULANT RESEARCH AND CONTROL SERVICE

The Australian Agricultural Council accepted a recommendation of the 84th Meeting of Standing Committee on Agriculture that testing of legume inoculants in Australia be financially supported by the states and that the testing be carried out at the Biological and Chemical Research Institute, Rydalmere.

Subsequently, the Australian Inoculant Research and Control Service (A.I.R.C.S.) was established and on July 1, 1970, it replaced the University-Department of Agriculture Liaison Services (U-DALS) which had been responsible for the testing of legume inoculants since 1956. Following the construction of a laboratory at Rydalmere, financed by contributions from Rural Credits Development Fund of the Reserve Bank and the Department of Primary Industry, Canberra, the A.I.R.C.S. unit moved from the University of Sydney on February 1, 1971.

AGRICULTURAL COLLEGES – TERTIARY STATUS

Hawkesbury and Wagga Agricultural Colleges adopted fully tertiary entrance requirements for students from the beginning of 1970. Later in 1970 the academic staffs were reviewed and from the beginning of 1971 academic salaries have been on the same scales as those for staffs of universities and colleges of advanced education.

SOME INDUSTRY DEVELOPMENTS AND TRENDS

IN THE LIVESTOCK INDUSTRIES

Low Wool Prices and High Sheep Numbers

The problems created by the fall in wool prices dominated the sheep industry in 1970–71. However, despite the increase in cattle and pigs as alternative enterprises, the number of sheep fell only slightly. An exceptionally high proportion of Merino ewes was joined with British breed rams for first cross lamb production. Crossbreeding took place in many large flocks that had been pure Merino for decades. There could be a problem in disposing of lamb carcasses in 1971–72 resulting from this increase in lamb production. Low wool prices also had other effects. Purchases of Merino rams from studs fell by as much as 50 per cent. There was a tendency for less shearing to take place in the autumn than formerly, because of heavier price penalties for wool containing burrs and grass seeds which are usually more prevalent in autumn-shorn fleeces. Requests for fibre diameter determinations by the Department's fleece measurement service rose steeply.

One Million More Cattle

Beef cattle numbers increased by nearly one million head from the previous year — a rise of approximately 23 per cent. Slaughterings of adult cattle increased significantly but there was a reduction of approximately 12 per cent in calf slaughterings so the net increase in beef and veal production was slight. The export situation remained static.

Cattle raisers showed greater interest in nutrition with more supplementary and lot feeding practices being adopted. There was also greater interest in scientific methods of selecting breeding stock. As a result of increased demand, artificial insemination services increased.

Pig Meat Production Continued to Increase

The number of brood sows in the state increased significantly while slaughterings reached a record level. The overall increase in pig meat production above that of the previous year was about 2 per cent but bacon and ham production increased by 16 per cent. Despite the increase in bacon and ham, more pigs were still killed for pork. The Australian consumption of pork reached 17.4 lb per capita in 1970–71 but the per capita consumption of bacon and ham was only 7.7 lb. Local consumption was the main outlet for pig meat.

Returns for Eggs Lower

The number of eggs received by the N.S.W. Egg Marketing Board rose by 10.6 per cent compared to the previous year. Production exceeded local demand and exports. The result was a large carryover of surplus egg pulp. Average returns to producers after payment of the hen levy were below those of the previous year and were less than the cost of production for many producers.

The trend for smaller egg producers to leave the industry continued and the number of farms with more than 15,000 layers increased.

The Minister for Agriculture established a committee of representatives of the industry and officers of the Department to review the industry's problems. The committee recommended a scheme to stabilise the egg industry which has been accepted in principle by all states except Victoria.

Chicken meat production also increased but was accompanied by greater local consumption.

Success in Tuberculosis Control Scheme

Cattle tested within the protected areas numbered 707,907 — a slight increase on the 700,151 tests in the previous year. The incidence of reactors was 0.062 per cent, representing the lowest incidence since the scheme commenced in 1960.

Outside protected areas, testing was confined to herds suspected of being affected. In this part of the state, testing increased greatly; 219,840 cattle were tested compared with 59,601 in 1969–70. The reactor incidence was 0.67 per cent. Under a new policy tuberculosis diagnosed in carcasses at abattoirs was, as far as possible, confirmed by laboratory examination, except in the case of cattle from known infected herds.

A significant change has occurred in the pattern of tuberculosis. When the official control scheme began in 1960 most infection occurred in dairy herds. However, 85 per cent of reactors detected during 1970–71 were beef animals. The change reflects the success of the control measures with dairy cattle and the move to large scale testing of beef cattle.

Brucellosis Control Programme Begins

Phase one of the brucellosis control programme, based on the recommendations of the National Sub-committee for Tuberculosis and Brucellosis, commenced during the year. This phase consisted of compulsory vaccination of female calves. Within protected areas, all female calves were vaccinated. Elsewhere vaccination was limited to infected herds. The total number of animals vaccinated was 596,504.

Plague Locust Outbreak Threatened

Extensive hatchings of the plague locust (*Chortoicetes terminifera*) occurred in the western Riverina, particularly in the Hay, Hillston and Narrandera districts, in the late autumn. Because ground control was not able to prevent swarming, a number of swarms were sprayed from aircraft. Aircraft fitted with boom sprays distributed 16,000 lb of technical fenitrothion and 32,000 lb of technical malidison at ultra low volume rates. Despite the large scale spraying programme, egg-laying was so widespread and heavy that a serious outbreak is expected in south western N.S.W. in spring and early summer, 1971.

Cattle Tick 100 Miles South of Quarantine Areas

A disturbing development was the finding of cattle ticks at Kempsey, in clean country 100 miles south of the quarantine areas. The infestation was discovered when a bull forwarded from Kempsey to the Byron Bay abattoir was found to be carrying a heavy burden of ticks. Preliminary arrangements were made for an eradication campaign involving the infested and adjoining holdings.

Within the tick quarantine areas, further cases of cattle tick resistance to the acaricides in general use were discovered. The declaration of affected and adjoining properties as special quarantine areas was necessary. At the end of the year, there were 16 such areas while a further six declared during the preceeding year were released.

IN FIELD CROPS AND PASTURES

Agricultural Research Institute and Director Honoured

The Agricultural Research Institute, Wagga Wagga, and its Director, Dr A. T. Pugsley, were each awarded commemorative medals in December, 1970. The medal was issued through the Food and Agriculture Organization of the United Nations and the Mexican Ministry of Agriculture to commemorate the contribution of Mexican wheats to the world wide fight against hunger. The awards to the Institute and Dr Pugsley recognised their participation in the work of the International Maize and Wheat Improvement Centre, Mexico.

Heron Leading Wheat Variety in Australia

The latest available statistics for the Commonwealth reveal that Heron was the leading wheat variety in Australia for the growing season 1968-69. It was sown on 4,832,804 acres — 17.8 per cent of the total acreage. This acreage represents the greatest area sown to a single variety in the history of the Australian wheat industry. Heron was produced and released by the N.S.W. Department of Agriculture in 1959.

Eagle — New Rust Resistant Hard Wheat Released

Extensive field and quality tests on the Department's wheat crossbred AR Falcon 28A culminated in its registration under the name of "Eagle" and its release in late 1970 for inclusion in official sowing recommendations for 1971.

This variety is resistant to all known strains of stem rust. It is also of special interest because it is the first time that a commercial wheat has been bred which includes in its parentage the distantly related wild grass species *Agropyrum elongatum*. The name "Eagle" was chosen at the time the American lunar craft "Eagle" landed on the moon.

Eagle is a hard wheat, acceptable in the N.S.W. hard class at the required protein level.

Hard Wheat Segregation in Southern N.S.W.

Grain of the variety Falcon was segregated at 87 southern receival points during the 1970-71 harvest. Half of the 1,100,000 bushels segregated was sold to local mills and the remainder comprised a special shipment to Peru — the first export of this type of wheat.

The Australian Wheat Board has indicated its satisfaction with the Falcon segregation experiment and suitable grain of both Falcon and Eagle from 1971 sowings will be segregated at an increased number of Grain Elevators Board installations.

Since the release of Falcon in 1960, the Agricultural Research Institute at Wagga Wagga has maintained its conviction that this wheat provided the means of fully exploiting the increased fertility of southern N.S.W. and incidentally lifting the quality ceiling for that area. Its outstanding ability to retain satisfactory baking quality in the lower protein range provided insurance against the disastrous quality characteristics of many hard wheats when grown on sites with low soil fertility.

Expanding Markets for Durum Wheats — New Variety Released

Further expansion of export markets for durum wheats is possible. Durum prospects have been helped by registration of the Department's new variety, Duramba. The inclusion of Duramba in recommendations for 1971 plantings in northern N.S.W. and increasing interest by the Australian Wheat Board in this type of wheat are also favourable developments.

Following the first overseas shipment to Kuwait of grain of the Dural variety in 1969, the Wheat Board arranged a further shipment during 1970 and accepted a firm reservation for a shipment from the 1970-71 harvest.

In 1970-71, durum wheats were grown on only 9,200 acres for a total production of 211,450 bushels. The 7,730 acres of Dural produced 178,450 bushels and the 1,470 acres of Duramba 33,000 bushels.

A special quota of 2,000,000 bushels of durum wheat was allocated to N.S.W. for the 1971 sowing season and all durum wheat sown was under contract following the issue of licences by the Wheat Board. The Premium Wheatgrowers' Association, in conjunction with the Board, contracted with growers for the sowing of approximately 60,000 acres of Duramba with the objective of producing 1,500,000 bushels of grain for expanded local and export use.

Record Barley Production

Record production demonstrated the increased interest of N.S.W. farmers in barley, particularly the malting types. The acreage sown to barley in 1970-71 was again a record, continuing the trend of the past twenty years.

The acreage of barley increased from 211,000 acres in 1960-61 to 432,000 acres in 1966-67, 640,000 acres in 1969-70 and an estimated 744,000 acres in 1970-71. Production rose from 4,700,000 bushels in 1960-61 to 12,300,000 bushels in 1969-70 and an estimated 18,900,000 bushels in 1970-71.

In 1969-70, the last season for which complete statistics are available, the production of two row (malting) types was about 20 per cent greater than production of six row (feed) types.

Further increases in yield per acre are expected to follow the recommendation of the new two row variety Clipper for 1971 sowings. In the Department's trials Clipper has yielded about 25 per cent better than Prior, which has been the standard malting barley variety for many years.

Oilseeds Production Expands Rapidly As An Alternative Source of Income

A rapid expansion in the acreage of oilseed crops has provided some relief from the restrictive impact of wheat quotas and low wool prices on farmers' incomes. The following table shows the increase in acreages and values of four oilseed crops over two years.

	1968-69		1970-71	
	Acres (a)	Value \$'000 (b)	Acres	Value \$'000 (b)
Rapeseed	negligible	Nil	58,000 (b)	1,760
Sunflower	4,400	111	212,000 (b)	6,500
Safflower	2,415	35	49,000 (a)	770
Linseed	15,164	327	50,750 (a)	2,110
Totals	21,979	473	369,750	11,140

Sources: (a) Bureau of Census and Statistics

(b) Department of Agriculture Estimates — capital city values.

Whilst the aggregate area in 1970-71 for the four crops listed has been estimated at 369,750 acres, it is significant that the total value of production exceeded \$11 million.

The very rapid expansion of oilseed acreage has highlighted the lack of practical experience with these crops and the need for more applied research. If the area continues to increase, and continues to include less favourable environments, crop failures are to be expected. It is also likely that marketing problems will arise, perhaps only temporarily, if production continues to expand rapidly.

Record Area and Production of Grain Sorghum

The area sown to grain sorghum in 1970–71 has been estimated at 450,000 acres, an 80 per cent increase on the previous record for the state. Production has been estimated at 18,000,000 bushels or about two and a half times the record production of the previous season.

Almost 90 per cent of the crop was grown in the north west of the state following lack of normal rains for wheat sowing. Summer rains in most districts were very good. Above normal yields resulted. The harvesting period was extremely dry and allowed a speedy intake of high quality grain.

The Australian Coarse Graingrowers' Association was very active in the marketing field. Export pools operated and markets were found, principally in Japan, for a large percentage of the production which was surplus to local requirements.

Lupins – Another Alternative to Wheat

The availability of the sweet, low-alkaloid lupin varieties with good rain retention characteristics has created interest in this crop as an alternative to wheat. The area sown in N.S.W. in 1970–71 was the largest so far. Yields of up to 35 bushels per acre were obtained on some farms in the southern parts of the state.

The variety, Uniwhite, bred by the University of Western Australia, was observed to have 15 to 20 per cent shattering when harvesting was delayed. An improved variety from the university, Uniharvest, proved completely non-shattering in trials at Yanco and Narrabri and had maturity and yield similar to Uniwhite.

Grain protein contents of 30 to 38 per cent make lupins a valuable source of protein for livestock and human foods on both local and export markets.

Natural Pastures Revalued

Livestock production in N.S.W. has always drawn heavily upon natural pastures but most limelight in the past half-century has been given to introduced pasture grasses and legumes sown in a prepared seedbed.

However, in recent years droughts have highlighted some of the weaknesses of introduced species and the strengths of native species. Natural pastures have also been valued because they provide areas safe from bloat when there are bloat problems with introduced legumes. The extensive naturalisation of exotic clovers, medics and "migrant" grasses has increased the grazing value of natural pastures and increased their potential for the cheapest form of improvement – topdressing with superphosphate. Finally, the advent of pasture improvement by aerial sowing and fertilizing has provided new scope for improvement of natural pastures without the necessity for costly land clearing and seedbed preparation.

IN THE FRUIT AND VEGETABLE INDUSTRIES

New Fungicide to Improve Disease Control on Food Crops

Use of the fungicide benomyl on food crops will facilitate greatly the control of a number of diseases including stone fruit brown rot, and sclerotinia and septoria diseases of vegetables. Previous control measures for these diseases have not been highly effective. This systemic fungicide had been previously registered in N.S.W. only for use on ornamentals and turf. The registration has now been extended to cover its use on growing crops of pome and stone fruits, vegetables and peanuts and as a post-harvest dip for stone fruits and bananas. The extended registration followed extensive testing in this state and consideration of disease control data presented by research workers elsewhere.

Trials in growers' packing sheds demonstrated that benomyl is more effective than TBZ in controlling black end, brown rot and squirter of bananas.

Disease Forecasting Service for the M.I.A.

A disease forecasting service to aid control of the fungus disease, brown rot of stone fruit, in canning peaches was established on the Murrumbidgee Irrigation Areas. Daily bulletins, issued from the local television station, kept growers informed of the movement of weather systems likely to favour the disease and the need for spray application. As a result, very little fruit was lost from brown rot in a season when weather conditions were extremely favourable for the disease.

The forecasting system was the culmination of some years of research on the disease and the co-operation of the Regional Director of Meteorology for N.S.W.

New Dessert Peach Varieties

Following evaluation of trials of dessert peach varieties at Bathurst and Narara Research Stations, four recent introductions (Maygold, Starking Delicious, Coronet and Redhaven) and two local selections (Fragar and Glenalton) are now being extensively planted to supplement the mid-season and late-maturing yellow-fleshed varieties, Halehaven, Blackburn and J. H. Hale.

An unnamed selection from the Bathurst station has produced heavy crops of excellent quality and is to be released. Some additional introductions from the U.S.A. are in quarantine awaiting release.

Mechanical Harvesting of Grapes and Prunes

Increasing difficulty in obtaining labour for harvest has given impetus to attempts to mechanise harvesting of fruit.

Systems using mechanical aids in conjunction with manual labour for harvesting grapes have been developed in the Hunter Valley and MIA and have shown potential in considerably increasing the efficiency of manual pickers. CSIRO has continued to test an imported one-wire fully mechanised harvester. Considerable interest is also being displayed in the self-propelled prototype of a half row mechanical harvester being developed by an Australian engineering company.

Funds from the Commonwealth Extension Services Grant have allowed the purchase of a mechanical harvester for prunes. This machine was received at Yanco just prior to the 1970-71 harvest. It was possible to carry out some pilot runs with the machine and, in co-operation with the Agricultural Engineering Section, a series of trials will begin in 1971-72.

Demand for Grapefruit

An increased demand for grapefruit that commenced as a diet fad about two years ago appears to have stabilised. Final figures are not available for 1970-71 but in the year ending June 30, 1970, the equivalent of 1,490,000 gallons of single strength grapefruit juice and some 30,000 bushels of fresh fruit were imported into Australia. For the three months ending September, 1970, 463,500 gallons were imported. Grapefruit production in 1970 was 220,000 bushels in N.S.W. and 650,000 bushels in Australia. The importation of juice in 1970 is equivalent to over 1,000,000 bushels of grapefruit. It is not likely that present plantings will meet this demand, so further plantings are warranted.

Large Area for Planting to Pecan Nuts

An overseas corporation has levelled 720 acres of silt plain in the Moree district in the first stage of an intended planting of about 2,000 acres of pecan nuts. Some 27,000 trees propagated on the property are ready for planting and a large number of seedlings has been raised for the propagation of trees to be planted in 1972 and 1973. Harvesting and processing equipment is to be imported and installed as the trees come into production. With the prospect of processing equipment being introduced to the area, other landholders have become interested in the establishment of smaller areas.

IN AGRICULTURAL ENGINEERING

Agricultural Engineering Centre Established

The Agricultural Engineering Centre was established at Glenfield at the end of 1970. It is the first centre of its kind in Australia.

The centre will conduct research to improve the mechanisation of agriculture, particularly in those industries which are not adequately catered for by large manufacturers. It will also construct prototype sophisticated machinery and instruments for use by the Department's research workers.

Already the centre has developed a prototype tomato harvester and cone-type seed and fertilizer pasture drill. An experimental tobacco curing kiln has been designed and constructed for tobacco research work. The high speed drying of grain, controlled atmosphere and environment storage for fruit, bulk handling of half bales of hay and aeration of grain are being investigated.

FINANCE — SUMMARY

Consolidated Revenue Fund Expenditure and Receipts

Expenditure from Consolidated Revenue Fund was \$20,244,176. This included \$3,112,549 for cattle tick control and \$738,125 for the upkeep of the Royal Botanic Gardens, Centennial Park and Admiralty House.

Expenditure by other government Departments on behalf of the Department of Agriculture is shown in the Public Accounts tabled in Parliament as an accompaniment to the Report of the Auditor General.

Receipts on Consolidated Revenue Fund were \$4,473,337 and these are shown in detail later in Appendix I "The Accounts of the Department of Agriculture 1970-71"

Capital Works

Capital works were constructed from General Loan Funds to the value of \$1,377,497. Details are given in the Appendix I to this report.

Trust Funds

Funds provided by industries, semi-governmental bodies, Commonwealth government grants and specialised taxations continue to rise. Substantial sections of the Department of Agriculture's research programmes and projects have been financed by these grants.

Receipts and expenditure in connection with these trusts and grants are recorded through the "Special Deposits Accounts" at the Treasury. Expenditure from these is regulated either by Act of Parliament or by such directions as may be given by the donor body, to whom the Department of Agriculture must account at the close of the financial year. The operations of the Special Deposits Accounts are reported in Appendix I.

COMMONWEALTH EXTENSION SERVICES GRANT

The Chief, Division of Extension Services, is responsible to the Director-General for administration of Commonwealth Extension Services Grant funds made available by the Commonwealth through the Department of Primary Industry to enhance extension services and applied research.

For 1970-71 the allocations for the various projects aggregated \$1,104,189 as against \$1,078,011 in 1969-70. Allocations for individual projects in 1969-70 and 1970-71 are compared in a table in the Division of Extension Services section of this report.

RESEARCH ADMINISTRATION/CO-ORDINATION OFFICE

THE RESEARCH PROGRAMME

Research priorities have been kept under close review because of the present difficulties engendered by rising production costs and falling prices for some of the traditional forms of rural production. Within the limits of funds and available manpower, the Department is re-deploying some staff and resources into research and development in alternative rural enterprises which are assessed to have good potential for economic viability and in which research is urgently required. In the more traditional industries, the Department is increasing research attention to efficiency and quality of production to reduce production costs and increase profitability. The aims are to widen the range of effective rural enterprises and to increase profitability of rural industries.

The opening of the new laboratory block at the Agricultural Research Station, Wollongbar in May, 1971, provided the basis for further development of that Station as a regional research centre for the whole north coast region. The Wollongbar Station will have sophisticated equipment and facilities that will enable it to also provide support for research at the Grafton and Alstonville Stations.

THE RESEARCH STAFF

The Department's research staff at March 31, 1971, comprised 428 officers, 56 of whom were either partly or wholly involved with research administration whilst 372 had research as their major function. Of the 56 research administrators, 10 also are engaged actively in research.

All the research administrators and 312 of the research workers were employed from the Consolidated Revenue Fund. Of the remaining 60 officers, 35 were employed from various Industry/Commonwealth Trust Funds, 23 from the Commonwealth Extension Services Grant, one from CSIRO funds, and one from funds made available from various sources to the Australian Inoculants Research and Control Service.

The Department has continued the policy of decentralising its research. The following table shows the distribution of research staff between head office, the laboratories that serve the whole state and regional laboratories and stations.

Location	Research Administration	Research	Total
Head office	23	74	97
Laboratories serving the whole state	11	122	133
Regional laboratories and stations	22	176	198
	56	372	428

Approximately 24 per cent of the total staff of the Department are engaged in research or research support, and approximately 25 per cent of the Department's total allocation of state funds is devoted to research. A substantial proportion of the research expenditure is being directed towards the Department's regional research services.

Research Scientist Classification

Six officers from the Department's research service were interviewed by the Public Service Board's Qualifications Committee for admission to the Research Scientist classification. This classification was established recently to provide an extended research career for research workers of exceptionally high calibre who may prefer to continue to specialise in research rather than become administrators to progress beyond the limits of the research salary range. One of the applicants was admitted to Senior Research Scientist classification and two to Research Scientist classification. These three officers were transferred to a special seniority list in the office of the Public Service Board and seconded back to the Department of Agriculture.

Post-Graduate Training and Overseas Study Tours by Research Staff

The Department continued its vigorous post-graduate training programme for research workers. During the year 31 officers (9 per cent of the research workers) were on study leave, engaged in post-graduate studies at universities either in Australia (21 officers) or overseas (10 officers); 56 officers (15 per cent of the research workers) were registered candidates for external Masters Degrees with various Australian universities; and 16 officers (4 per cent of the research workers) undertook overseas study tours, mostly of about three months' duration. The research projects registered for external Masters Degrees were in whole or in part, the officers' Departmental projects.

The Department also maintained its in-service training programme with assistance from industry funds. Grants were made by the Australian Wool Board for eight officers to work on approved projects with CSIRO or university research teams, and the Australian Meat Research Committee supported one similar project. These periods of post-graduate training are mostly of two or three years' duration.

REPRESENTATION ON WHEAT INDUSTRY RESEARCH COUNCIL

The Research Co-ordinator, Mr K. E. Hutton, participated in the 1971 Budget Meeting of the Wheat Industry Research Council in Canberra in lieu of Dr F. C. Butler, Senior Deputy Director-General.

RESEARCH GRANTS FROM INDUSTRY AND COMMONWEALTH FUNDS

The Department's research programmes continued to receive very effective support through research grants from Industry/Commonwealth Trust Funds, from the Commonwealth Extension Services Grant and from other sources. These grants provided support to the basic state contribution

to the research services and greatly enhanced the Department's research capability. An additional value of industry-funded projects is in the matching of Departmental and industry judgments on research priorities.

The main research grants received from industry and Commonwealth sources in 1970-71 are tabulated in the accompanying table and compared with grants from similar sources in the previous two years (see below).

Additional grants were received from various other industries for specific purposes, for example, Arnott's Biscuits Pty Ltd, have contributed \$8,000 annually since 1968-69 to assist the Department. This contribution assists in a wheat breeding and agronomic and quality evaluation programme designed to develop a suitable low-protein, soft wheat which is also resistant to rust and high-yielding. The wheat would be grown in southern irrigation areas for the production of high-quality biscuit flour.

Research Grants from Industry and Commonwealth Sources
1968-69 to 1970-71

Fund	1968-69 \$	1969-70 \$	1970-71 \$	Total \$
Commonwealth Extension Services Grant (Estimate of Research Component)	\$559,941	\$594,101	\$409,536	\$1,563,578
*Industry C.E.S.G. Special Research Fund		43,600	14,900	58,500
Wheat Industry Research Committee of N.S.W.	105,588	155,315	138,604	399,507
Wheat Industry Research Council	51,106	71,607	52,066	174,779
Wheat Industry Stabilisation Fund	8,350	4,500		12,850
Australian Meat Research Committee	158,598	140,187	166,996	465,781
Wool Research Trust Fund	159,611	274,550	388,097	822,258
Australian Wool Board Post-Graduate Scholarships	16,520	19,200	19,683	55,403
Australian Dairy Produce Board	65,944	63,557	80,156	209,657
Banana Research Advisory Committee	9,900	9,250	10,605	29,755
Tobacco Industry Trust Account	77,760	54,520	55,695	187,975
Australian Apple and Pear Board	10,420			10,420
Rural Credits Development Fund			10,000	10,000
Council of Egg Marketing Authorities of Australia		12,710	2,250	14,960
Australian Chicken Meat Research Committee			5,750	5,750
	\$1,223,738	\$1,443,097	\$1,354,338	\$4,021,173

*Grants from the mushroom (\$4,150), citrus (\$1,000) and bean (\$2,300) industries were matched equally by the Commonwealth through the C.E.S.G./Special Research Grant.

Research grants in 1970-71 from the sources tabulated were \$88,759 lower than in the previous year. The reduction was due mainly to a decrease of \$184,565 in the allocation to the research component of the Commonwealth Extension Services Grant. The grants from the Industry/Commonwealth Trust Funds increased by \$85,806 to a total of \$934,802. However, the present and projected levels of income to some of these Trust Funds are such that, with the rapidly increasing cost of conducting research, it has become necessary to plan for the progressive curtailment of some of the programmes to contain them within projected budget estimates.

One new industry fund, administered by the Australian Chicken Meat Research Committee, commenced during 1970–71; the Department obtained an initial, small grant. A grant was obtained also from the Rural Credits Development Fund to assist the Department in constructing emergency laboratory accommodation for the Australian Inoculants Research and Control Service.

NEW PROJECTS WITH INDUSTRY AND COMMONWEALTH FUNDS

The following new projects were approved and initiated with industry and Commonwealth funds.

Australian Wool Board

Agricultural Research Station, Trangie.—Applied economic research in the wool industry — Trangie Agricultural Research Station — \$3,440; supply of neutron moisture meter — \$3,600.

Agricultural Research Station, Tamworth.—Integration of pastures and forage crops on the north-west slopes — \$69,295.

Division of Animal Industry.—Development of the economic-management approach in sheep industry extension — \$8,190.

Division of Animal Industry (in co-operation with CSIRO, Division of Mathematical Statistics, Sydney).—Development and field evaluation of mathematical models for estimating reproductive wastage and fertility on flock matings — \$3,700.

Agricultural Research Station, Leeton and CSIRO, Division of Animal Physiology, Prospect.—Joining and mating strategies with sheep — \$6,170.

Biological and Chemical Research Institute, Rydalmere.—Development of field and glasshouse tests for potassium and phosphorus — \$9,750; root diseases and the decline of subterranean clover in southern N.S.W. — \$11,550.

Agricultural Engineering Centre, Glenfield.—Development of mechanized handling techniques for baled hay — \$7,000.

Agricultural Research Station, Bathurst.—Development of aerial pasture improvement techniques for the central districts — \$3,900.

Division of Marketing and Economics.—Training of an economics research officer for work in the sheep industry — \$3,020.

Division of Plant Industry (in association with the University of New England, Armidale).—Training of a research agronomist — ecology under grazing of forage species in western districts — \$5,875.

Agricultural Research Station, Condobolin.—Evaluation of pasture and forage species — central west — \$6,665.

Agricultural Research Station, Narrabri.—Evaluation of pasture and forage species — north west plains — \$6,730.

Australian Meat Research Committee

No new beef projects were supported in 1970–71. However, the following new mutton and lamb projects were initiated:

Agricultural Research Stations, Glen Innes and Temora.—DAN 8S — Evaluation of potential fine-woolled, meat sheep — \$7,430.

Wheat Industry Research Committee of N.S.W.

Agricultural Research Institute, Wagga Wagga.—Soil nitrogen, overseas study — R. R. Storrier — \$1,500; air-conditioning of experimental milling laboratory — \$4,000; wheat climate fertilizer relations — \$4,250.

Wheat Industry Research Council

Agricultural Research Institute, Wagga Wagga.—Travel grant for integration of wheat research — \$800.

Australian Dairy Produce Board

Biological and Chemical Research Institute, Rydalmere and Agricultural Research Station, Wollongbar.—Insecticide residues in dairy cattle and dairy products — \$4,670.

Hawkesbury Agricultural College, Richmond.—Use of calcium co-precipitates in manufactured meats — \$2,200.

Council of Egg Marketing Authorities of Australia

Biological and Chemical Research Institute, Rydalmere and Poultry Research Station, Seven Hills.—Pesticide residues in eggs — \$2,250.

Australian Chicken Meat Research Committee

Division of Animal Industry.—Improvement of brooding techniques — \$5,750.

Commonwealth Extension Services Grant

Funds from this source were used, in part, to improve the research facilities at many of the central laboratories and decentralized research centres. Some major allocations for this purpose were:

Biological and Chemical Research Institute, Rydalmere.—Milling laboratory modifications and equipment — \$11,200; equipment and maintenance items for electron microscopy unit — \$9,150; equipment and expendable items for chemical analysis — \$4,100.

Agricultural Research Station, Wollongbar.—Completion of laboratory block — \$43,963; dry stock house for pig research unit — \$6,000; equipment and expendable items for research programmes — \$16,600.

Veterinary Research Station, Glenfield.—Completion of agricultural engineering centre building — \$27,350; equipment for agricultural engineering centre — \$12,000; equipment for the drought nutrition research unit — \$12,000.

Agricultural Research Institute, Wagga Wagga.—Irrigation equipment for research — \$8,000.

Agricultural College and Research Station, Yanco.—Mechanical tree shaker for fruit harvesting research — \$5,600; wheat irrigation research equipment — \$3,300.

Tropical Fruit Research Station, Alstonville.—Facilities for controlled atmosphere storage of bananas — \$2,500.

Agricultural Research Station, Narrabri.—Equipment for soybean research — \$1,420.

NEW PROJECTS WITH STATE FUNDS

Thirty-nine new, major projects were approved in 1970–71.

Division of Plant Industry

The study of acid soil infertility and means of overcoming such infertility problems.

Division of Extension Services

Distribution of work time of extension officers.

Division of Horticulture

Citrus fruit quality investigations. Methods of spraying for control of two-spotted mite. Prune rootstock and intermediate stem piece trial. Clonal strain testing — canning peaches. Clonal strain testing — dessert peaches, Bathurst. Peach rootstock trial — dessert varieties. Comparison of tile and plastic drains. Cabernet auvignon clonal selection trial. Semillon pruning and trellising experiment. Maturity testing of avocados.

Division of Animal Industry

Amino acid requirements of turkeys. Dwarf gene-ladykiller gene inheritance studies. Nutrient density and carcass quality of pekin ducklings. Deficiencies in matured pastures of the Clarence Region restricting growth of cattle. Comparison of various energy sources as supplements for grazing dairy cattle. Phosphorus nutrition studies with beef cattle. Feed intake studies with grazing beef cattle. Prime lamb production on the lower Clarence River alluviums. The identification of twin-bearing ewes. Mineral and vitamin nutrition of the growing pig.

Agricultural Research Station, Tamworth

The utilization of winter cereals for forage. The response of lucerne to seasonally applied nitrogen topdressing. Factors governing the occurrence, persistence and effectiveness of naturalised and introduced root-nodule bacteria on legumes in the north west slopes. Examination of a forage sorghum under dryland conditions in terms of livestock performance. Wheat frost injury. Crop environment relationships – north west N.S.W. Ecology of *Verticillium dahliae* in relation to wilt of cotton and other field crops. Effect of legumes on the productivity of wheat-growing soils. Nutrition of crop and pasture species on wheat belt soils. Nutrition of crop and pasture species on tableland soils. North west wheat improvement.

Division of Marketing and Economics

The structure of farm businesses in the lower Hunter. Decision-making by beef producers in the Clarence Valley. Whole farm studies – far north coast. Optimum feed year programmes – north coast; and farm development plans – north coast dairy farms. Factors impeding adjustment on low-income north coast dairy farms.

Division of Dairying

A programme of cow hygiene in relation to mastitis control and milk quality.

BIOMETRICAL BRANCH

General

The volume of consulting work of the Biometrical Branch continued to increase with the increase in the level of training of research staff in the Department.

Major computer programmes were revised to increase their efficiency.

A computer terminal for use with time-sharing computers was installed in the Branch. This has greatly improved computing facilities. Funds for this type of computing came from the Commonwealth Extension Services Grant.

Staff Changes

Two trainees in agricultural science completed their studies and took up duties as biometricians in December, 1970, and February, 1971. One position of biometrician was transferred to the Agricultural research Station, Wollongbar, in January, 1971.

Post-Graduate Training, Study Leave

Two biometricians successfully completed first year and commenced second year of part-time study in qualifying courses for Masters Degrees at the University of N.S.W. One biometrician was granted full-time study leave from March 19 to July 1, 1971, to allow him to take up a Commonwealth Post-Graduate Course Award to complete requirements for the Master of Statistics Degree at the University of N.S.W. One biometrician, a graduate in agricultural science, commenced part-time study for the B.A. Degree in mathematics and mathematical statistics at Macquarie University.

Overseas Visit

The Deputy Chief Biometrician was overseas from August 15 to September 10, 1970. He attended the 7th International Biometric Conference in Hanover and visited research establishments in Europe, Britain, North America and New Zealand to study methods of evaluating research data. Funds for this visit came from the Commonwealth Extension Services Grant.

AUTOMATIC DATA PROCESSING (ADP) SECTION

Fruit Tree Census

Calculation of planting statistics and reporting results following a state-wide census of all fruit trees, vines, etc., standing and alive, as at December 31, 1970, was completed in June, 1971. This was the second census to be carried out under the ADP system developed for this work.

Beef Cattle Performance Recording

Performance records for about 8,500 animals in 34 herds in N.S.W. are being processed under the ADP system developed for this work in 1968. Several herds in Queensland and Tasmania are also having their data processed through the N.S.W. system, pending the introduction of a national recording scheme planned for July, 1972.

The programmes developed for the N.S.W. system will be used as a basis for the national scheme. These programmes are at present being modified to incorporate the recommendations of the committee responsible for introducing the national scheme.

Plant Pathology Herbarium Collection

Programming of the first stage of an ADP system to record, index, catalogue and retrieve information in connection with the Plant Pathology Herbarium Collection maintained at the Department's Biological and Chemical Research Institute, Rydalmere, was completed. Capture of data relating to each specimen is now proceeding.

Dairy Herd Recording

Re-programming of the ADP system for dairy herd recording, necessitated by a change in computing equipment, is continuing. The change-over to the new machine, a Honeywell H-8200, is to be effected on December 31, 1971.

ADP Training Course

During the year 19 officers of the Department attended ADP training courses conducted by the Treasury ADP Service Bureau.

LEGAL BRANCH

Acts

The Legal Branch was involved in the work leading to passage of the following Acts by Parliament: Wheat Quotas Act, 1970; Meat Industry (Amendment) Act, 1970; and Marketing of Primary Products (Amendment) Act, 1970.

Regulations, Proclamations and Notifications

There were gazettals of 21 regulations, 83 proclamations and 44 notifications.

Loans

A total of 21 Executive Council Minutes were prepared in respect to loans proposed on behalf of the Grain Elevators Board and the Sydney Farm Produce Market Authority.

Prosecutions

The Branch prepared 75 informations for prosecutions for offences under the various Acts administered by the Department. Several prosecutions were undertaken by the Crown Solicitor on behalf of the Department because of insufficient professional legal officers.

Arbitration under the Agricultural Holdings Act 1941

Four matters were referred to arbitration but none has reached completion.

Registrations

Registrations effected in 1970-71 (with 1969-70 figures in brackets) were: Farm Produce Agents — 254 (275); and Veterinary Surgeons — 884 (821).

The Board of Veterinary Surgeons of N.S.W. met on thirteen occasions.

DIVISION OF RESEARCH STATIONS

GENERAL

STAFF

Obituary

Mr Eric Codner Powell died suddenly whilst returning home from work on May 4, 1971. Mr Powell served as experimentalist, district agronomist, and farm manager and then as Special Agronomist (Management) and Principal Officer (Management) — positions he held with great devotion to duty.

Appointments

Mr C. R. Hood, previously Assistant Principal Officer (Management), was appointed to the position of Principal Officer (Management) in place of the late E. C. Powell. Mr D. A. Pearson, formerly Manager, Agricultural Research Station, Wollongbar, was appointed as Assistant Principal Officer (Management) and Mr B. C. Roberts, formerly District Livestock Officer (Sheep and Wool) Albury, was appointed to the newly-created position of Assistant Principal Officer (Drought).

The appointment of an Assistant Principal Officer (Drought) relieved the Chief and the Deputy Chief of the Division of a considerable amount of the detailed administration and supervision of drought relief and Western Division Public Watering Places.

The appointment of an Agricultural Engineer, and the filling of positions of Work Shop Manager, Draftsman, Laboratory Craftsmen (2) and Office Assistant completed the first stage of the staffing for the Agricultural Engineering Centre Glenfield, approved by the Public Service Board.

Other new positions created and filled were: Senior Agricultural Machinery Officer in head office; Agricultural Machinery Officer, Tamworth; and a second position of Plant Inspector. The creation of a second position of Plant Inspector was to handle procurement, inspection, routine maintenance and disposal of scientific instruments and laboratory equipment. A need for additional assistance in the Plant Inspector Section still remains.

Research Stations. — An Assistant Manager was appointed to Trangie Agricultural Research Station in November, 1970 — the first such appointment. The establishment of Assistant Manager positions on research stations will enable suitable officers to train “on the job” in management and administration.

Western Division. — The approved re-organization of the Western Division Public Watering Places maintenance staff by the creation of two positions of Assistant Supervisor and four Field Officers under the control of the Supervisor, had little beneficial effect in 1970 because of the difficulty in obtaining suitable staff. Improvement is expected soon with the appointment of a suitably experienced man as the first Assistant Supervisor and the filling of the four Field Officer positions.

Architects Section. — The pressure on the Architect's section in maintenance and miscellaneous works was relieved in some degree by the increase in establishment by one Senior Technical Officer. However, the resignation of a capable and experienced architect limited the capacity of the section to undertake design work on the larger projects for which funds will become available in 1972.

Ministerial and support staff. — Curtailment of employment of Ministerial staff, due to financial stringencies, resulted in arrears of farm and maintenance work on Condobolin, Cowra, Griffith, Leeton and Narara Agricultural Research Stations. The support staff situation, both Ministerial and General Division, on Wollongbar Agricultural Research Station was critical — the construction of the Regional Laboratory complex at a cost of approximately \$600,000 and an increase in professional staff and research activity was not accompanied by appointment of the required support staff.

Lack of laboratory support staff resulted in arrears of laboratory work at Wollongbar and Condobolin and vacancies and or shortages of support staff restricted research at Alstonville, Bathurst, Grafton and Wollongbar Research Stations.

Training

Courses on work safety were organised for field staff on a number of research stations to make them more aware of work safety and to highlight danger zones in work operations.

Agricultural Machinery Officers visited other regions during the year to gather information on mechanisation and, with the Agricultural Engineers, also attended the Australian National Farm Machinery Field Days at Orange.

The Managers at Condobolin and Narrabri Agricultural Research Stations attended Public Service Board short courses in management conducted by the Institute of Administration at the University of New South Wales.

Extension officers in training from various Divisions of the Department continued to be located on most research stations for training under supervision of the Manager. University and college trainees were located at various research stations during vacations for practical training.

Most research stations conducted regular seminars for professional officers.

Committees

Formal committees of which officers of the Division were members included: the Standing Committee on Drought Relief, the Standing Committee on Unemployment Drought Relief, the Agricultural Machinery Sub-Committee of Review (Wheat Industry Research Council), a Sub-Committee of the Board of Secondary School Studies (Agricultural Engineering Course – Higher School Certificate), the Board of Studies (Curriculum of Hawkesbury and Wagga Agricultural Colleges), the Executive Advisory Committee for Safety in Rural Industries, the Bush Fire Council of N.S.W., the Intra-Departmental Committee on Occupational Safety and Occupational Health, and the organizing Committee of the National Farm Machinery Field Days.

The Agricultural Engineer was appointed to two working parties, arranged by the Department of Primary Industry at the request of the Standing Committee on Agriculture, to undertake critical reviews on the present position in Australia regarding the mechanical harvesting of tree fruits and vegetables.

Bush Fire Council of New South Wales

The Agricultural Engineer represents the Department of Agriculture on the Bush Fire Council. He also serves on its Technical Sub-Committee. Agricultural Machinery Officers conducted two schools for Bush Fire Brigades in country districts with the aim of helping members to maintain their equipment in proper condition.

Standardisation of Farm Machinery

Standardisation of farm machinery is a function of the Standards Association of Australia. The Agricultural Engineer is Chairman of the Standards Association Committee on Farm Safety. During the year two standards concerned with agricultural engineering and machinery were finalised and published – “Uniform symbols for controls on agricultural machinery” and “Power take off guards”. Another standard – “Location and direction of motion of operator controls” has been completed and is being prepared for publication. Other Standards being considered are – tractor noise, tractor and trailer brakes and seat belts.

The Agricultural Engineers examined a number of new standards from other countries which were relevant to Australian farm machinery and forwarded comments to the Standards Association of Australia.

Research-Extension-Industry Liaison

Agricultural Machinery Officers visited research stations and institutes in their regions and have had talks with farm managers, research workers, foremen and machinery operators to obtain the benefit of their experience with farm machinery. Visits were made to the Agricultural Engineering Section of the University of Melbourne, University of New South Wales and the CSIRO Engineering Sections at Ryde and Griffith. Contact was maintained with the Mechanical Engineering Section of CSIRO in Victoria, the farm machinery section of the Victorian Department of Agriculture and with the Canadian Department of Agriculture (about C.A. storage of fruit). Arrangements were made to obtain research papers delivered at Meetings of the American Society of Agricultural Engineers and research reports from the Japanese Institute of Agricultural Machinery.

The Agricultural Engineers attended and participated at meetings of the Agricultural Engineers Branch of the Institution of Engineers (Australia), the Australian Lead and Galvanised Iron Development Association Conference, local government machinery field days and the 1970 Cereal Agronomy Conference.

CAPITAL WORKS PROGRAMME

Expenditure

The Department's capital works programme, financed from General Loan Account, States' Grants (Advanced Education) Act, States' Grants (Technical Training) Act, Commonwealth Extension Services Grant, and industry and other funds, involved an expenditure of almost \$1,955,000.

Expenditure from the various sources was: General Loan (excluding amount transferred to Advanced Education) \$639,997; States' Grants (Advanced Education) Act \$567,778; States' Grants (Technical Training) Act \$373,241; Commonwealth Extension Services Grant \$175,688; and Industry and other funds \$197,891.

The total was \$1,954,595.

Major Works Completed or Almost Completed

Major works completed or almost completed, with approximate cost in brackets, were: Wollongbar — Regional Research Laboratory and Office Complex (\$605,700); Condobolin — New Offices and Laboratory (\$372,000); Seven Hills — New Offices and Laboratory (\$302,000); Glenfield — Agricultural Engineering Centre (\$87,000); Trangie — Irrigation Development (\$88,000); Hawkesbury College — Animal Husbandry Unit Stage II (\$136,000); Physics Laboratory and Science Room (\$215,000) and Food Technology Tutorial Block (\$293,000); Wagga College — Animal Plant and Science Laboratory (\$369,000), Dining Room and Kitchen (\$340,000), and Erection of Dairy Building (\$111,000); Orange College — Road Works (\$90,000); Griffith — Experimental Winery (\$65,000); Wagga College — Block B Residential Accommodation (\$280,000), and Student Unit (\$176,000); and Wollongbar — Dairy Buildings (Stage I) (\$25,000).

Work Commenced

Stage I of the Orange Agricultural College Campus to cost \$1,200,000 was commenced in May, 1971. It includes student accommodation blocks, staff residential flats and essential services.

General Loan Account Funds

The allocation from the General Loan Account for 1970–71 was \$640,000. Expenditure was \$639,997. Jobs undertaken or in progress with funds from the General Loan Account were:

WORKS	ESTIMATED COST	EXPENDITURE 1970–71
	\$	\$
<i>C.B. Alexander Agricultural College:</i> Acquisition expenditure	520,000	NIL
<i>Condobolin Agricultural Research Station:</i> Laboratory & Administration Building	371,500	322,569
<i>Dareton Horticultural Research Station:</i> Alternative Irrigation Supply	35,500	NIL
<i>Glenfield Veterinary Research Station:</i> Virology Laboratory & Conference Room	521,400	6,244
<i>Griffith Viticultural Research Station:</i> Experimental Winery	65,400	10,000
<i>Royal Botanical Gardens:</i> Exhibition Glasshouse	105,200	122
<i>Rydalmere Biological & Chem. Res. Institute:</i> Rabbit House	7,000	7,000
Cotton Testing Laboratory	17,500	11,000
<i>Seven Hills Poultry Research Station:</i> Laboratory & Administrative Building	302,200	206,736
<i>Tamworth Agricultural Research Station:</i> Water Supply	16,400	862
<i>Temora Agricultural Research Station:</i> Shearing Shed	9,400	9,383
<i>Trangie Agricultural Research Station:</i> Irrigation Development	65,500	19,931
Foreman's Office and Store	10,300	9,814
<i>Wagga District Veterinary Laboratory.</i>	340,000	NIL
<i>Wollongbar Agricultural Research Station:</i> Dairy Building and Bails	24,400	14,957
Research Laboratory — Additional Equipment	50,000	9,804
TOTAL	\$2,461,700	\$639,997

States' Grants (Technical Training) Act Funds

The programme of \$800,000 for the first triennium was completed during 1970–71 with expenditure for the year of \$8,311. Expenditure during 1970–71 for the second triennium ending June 30, 1971 was \$364,929 which, with carry forward of \$87,453, will complete payment of all works within the original grant of \$1,227,000. The Department has been allocated \$2,169,000 for the third triennium commencing July 1, 1971.

Details of expenditure for the 1970-71 programme are:

WORKS	ESTIMATED COST	EXPENDITURE 1970-71
	\$	\$
<i>Hawkesbury Agricultural College:</i>		
Animal Husbandry Unit Stage I	84,000	6,621
Animal Husbandry Unit Stage II	136,300	83,587
Physics Laboratory and Lecture Rooms	215,200	153,322
Miscellaneous Plant, Equipment, Teaching Aids, Machinery	29,400	918
Steam line from Dairy to Kitchen	40,800	1,690
P.A.B.X. Switchboard	19,000	14,369
<i>Wagga Agricultural College:</i>		
Animal and Plant Science Laboratory	303,700	85,114
Demonstration Rooms, Beef, Sheep and Dairy	20,300	5,479
Erection of Dairy Buildings	31,200	122
<i>Yanco Agricultural College and Research Station:</i>		
Accommodation Block	294,600	4,251
Animal Demonstration Unit Stage II	5,800	1,843
Miscellaneous Plant, Equipment, Teaching Aids, Machinery etc.	12,000	2,081
Shearing Shed and Yards	18,600	13,843
TOTAL	\$1,210,900	\$373,240

States' Grants (Advanced Education) Act Funds

Under the States' Grant (Advanced Education) Act Fund of 1969 the Department received a total allocation of \$4,844,000 of "matched" grants. During the 1970-71 financial year, \$532,578 was expended on "Works in Progress" and \$35,200 on "Completed Works", a total expenditure of \$567,778.

WORKS	ESTIMATED COST	EXPENDITURE 1970-71
	\$	\$
<i>Hawkesbury Agricultural College:</i>		
Erection of Poultry Section Stage II	31,000	19
Residential Accommodation	210,300	6,696
Demolition of Site Works	32,700	NIL
School of Food Technology (Tutorial Block)	293,000	160,519
Food Technology Processing Building	1,402,400	NIL
Roadworks	41,600	NIL
Alterations to Dairy Technology Buildings	33,000	31,073
Plant and Equipment	38,500	NIL
P.A.B.X. System	24,000	23,500
Cottage for Lecturer	18,100	18,130
<i>Orange Agricultural College:</i>		
Student Accommodation	705,960	6,461
Administration Building	290,600	916
Essential Services	353,200	1,306
Roadworks	90,000	59,586
Plant and Equipment	35,000	7,501
Ancillary Buildings	199,000	307
Livestock	30,000	16,431
Fencing	5,000	2,451
<i>Wagga Agricultural College:</i>		
Residential Accommodation	413,300	5,524
Animal and Plant Science Labs.	64,700	35,788
Dining Room and Kitchen	341,300	124,804
Boiler	67,500	NIL
Dairy Buildings	79,800	36,186
Plant and Equipment	18,600	NIL
Cottage for Chief Lecturer	17,000	17,070
Roadworks	53,300	13,351
Sewerage Treatment Works	4,000	158
TOTAL	\$1,974,400	\$567,778

Commonwealth Extension Services Grant Funds

The Regional Research Laboratory and Office Building at Wollongbar Agricultural Research Station were completed, except for minor alterations and additions, at a cost of \$605,657 including equipment. Funds were provided from C.E.S.G. (\$555,657) and General Loan (\$50,000). Mill room modifications (\$10,000) and a nutritional glasshouse (\$14,300) at Rydalmere were also completed.

Industry and Other Funds

The following works were completed or almost completed during the year:

Glenfield Veterinary Research Station:

Pathogen Free Poultry Building \$10,000

Rydalmere Biological & Chem. Res. Institute:

Glasshouse Legume Research \$25,000

A.I.R. & C.S. Laboratory \$19,300

Tamworth Agricultural Research Station:

Glasshouse for Frost Resistance \$22,000

Glasshouse Plant Quarantine \$16,000

Trangie Agricultural Research Station:

Carcass Dissection Laboratory \$22,400

The Pasture Research Laboratory at Tamworth (\$90,000) was commenced and was well on the way to completion.

RESEARCH STATIONS

IMPROVEMENTS

Acquisition of Land

Wollongbar Agricultural Research Station acquired a further 236 acres of land on lease from the Department of Education for the research programme including investigations of insecticide residue effects in dairy cattle.

Fencing

Expenditure on fencing was \$8,000 compared with normal expenditure of \$15,000. Boundary fencing was erected around the recently acquired land at Grafton and the boundary fence at Orange was completed. At Griffith Viticultural Research Station the greater portion of seven acres of recently planted vines was intensively trellised for a trellising trial. Apart from this boundary fencing, most of the work carried out was in connection with maintenance of existing structures. It included extensive renovation of fencing at Seven Hills, Tamworth and Wollongbar.

Water Supply and Irrigation

Added storages were constructed at Narara and Glen Innes Stations. At Tamworth and Trangie electrical extensions associated with new irrigation areas were installed at a cost of \$6,750. "Trickle" irrigation systems were installed at Dareton and Orange, and drag hose sprinkler irrigation systems at Dareton and Narara.

Maintenance of all domestic and stock water supplies was satisfactory. Water quality problems developed at Wollongbar and are being investigated.

Road Works

Expenditure on road works was \$5,720 compared with a normal expenditure of \$10,000. The curtailment was a result of the shortage of money.

At Alstonville, further grading and gravelling of roads and some bitumen sealing provided all weather access to the development areas of the Station. Road work was also undertaken at Dareton. Heavy rains caused extensive damage to Bathurst Research Station and floods damaged road works at Narrabri. Repairs were effected at both Stations. Approximately 2,000 sq. yards adjacent to the main building area at Glen Innes was resurfaced. At Wollongbar, the main Station drive was sealed, kerbed and guttered. Other areas adjacent to the buildings and subject to heavy traffic were also sealed.

Aesthetic Improvements

The construction of further sealed roads has improved the appearance of the Stations involved.

New administrative and laboratory buildings at Wollongbar, Seven Hills and Condobolin have greatly improved the appearance of these Stations. Further benefit is being obtained as lawn surrounds are developed. The areas adjacent to these buildings will be landscaped as funds are available. Detailed plans have been prepared by the Senior Landscape Designer, Royal Botanic Gardens.

Flooding

There was major flooding at Narrabri Agricultural Research Station in January and February. The floods were the most severe experienced in north-western N.S.W. Extensive damage occurred to fences, earth works and research plots. There was little damage to buildings due to the provision for flooding made in their construction. Losses of and damage to stock, equipment and stores were far below the level that could have been expected due to exceptional efforts by the Manager and Foreman. Restoration of the flood damage, together with other essential work, fully extended the Station staff. However, it has been completed.

Approximately one-third of Trangie Agricultural Research Station was inundated by flood waters from the Macquarie River as a result of heavy rains in January and February. Flood waters damaged some four miles of fencing but there was very little loss of material and the fences have been repaired and straightened where necessary. Severe washaways occurred in the Trangie-Nevertire Scheme's 250 cusec channel which supplies the Station and other members of the Scheme. The damage delayed the completion of the construction of the channel until March, 1971.

Flood Mitigation and Earth Works

The 250 cusec channel from the Macquarie River to Trangie Agricultural Research Station was completed in March, 1971. The Station's supply channel from the main channel was also completed and tested.

Additional drainage work was carried out on the Wollongbar Station's Duck Creek Sub-Station. The pressing demand for land at Wollongbar is resulting in an increased use of the Duck Creek Sub-Station for research projects and as a result, further drainage works are necessary.

The incorporation of additional land in the Narrabri Station's irrigation and drainage systems necessitated building of earth works.

Heavy storms at Narara, and the associated Somersby Sub-Station, caused more extensive erosion than has occurred for many years. Erosion damage also occurred at Bathurst Station. Restoration work is in hand at the three Stations.

Tile drainage was installed on a further 11 acres at Griffith Viticultural Research Station preparatory to reclamation.

At Wollongbar, an area of 50 acres of steep country was contour banked by the Soil Conservation Service to render it suitable for research purposes. The Service also assisted in the provision of graded banks on an additional 60 acres at Glen Innes and in the renewal of contour banks on 100 acres at Cowra Research Station.

Land Clearing and Tree Plantings

Clearing of 300 acres of land attached to Grafton Agricultural Research Station continued. All stations maintained existing tree lots and wind breaks whilst further plantings were made on Orange, Bathurst and Cowra Stations and on Shannon Vale and Somersby Sub-Stations.

Approximately one acre of experimental Poplar was planted at Wollongbar Agricultural Research Station in conjunction with the Forestry Commission.

Machinery and Equipment

Expenditure from Consolidated Revenue funds on equipment, apparatus, and machinery of a major nature (in excess of \$200) including mowers, a forage trailer, tractors, headers, balers, a dehumidifier, scales, a mist propagator, land levellers, pH meters and similar equipment was \$86,600.

Plant and equipment for use on research stations to the value of \$44,600 was purchased from Commonwealth Extension Services Grant funds. It included plant and equipment costing \$17,000 for the new Regional Research Laboratory at Wollongbar and \$10,000 for the Agricultural Engineering Centre at Glenfield.

Industry funds also made substantial grants for material, plant and equipment for research projects at the various stations.

Motor Vehicles

A total of 89 existing motor vehicles was replaced and 52 additional motor vehicles of various types ranging from small sedans and mini mokes to trucks and caravans were delivered. This compared to 48 replacements and 52 additional motor vehicles in the previous year. The Department's motor fleet is now 394 vehicles.

Stores and Minor Plant

Research stations stores, minor plant and equipment, repairs to plant and equipment and other essential services, aggregated \$232,500 from the Consolidated Revenue Funds, with sizable further contributions from the Commonwealth Extension Services Grant and Industry funds.

ACTIVITIES AT RESEARCH STATIONS

Seed and Fodder Production and Use

Winter cereal seed. — Winter cereal pure seed harvested at research stations met the Department's need for domestic crop production (3,000 bushels of various types — wheat, oats, barley and cereal rye).

Grains. — Seasonal conditions were more satisfactory for grain production than in the previous season. Total grain production of winter cereals on research stations was 70,000 bushels. This production was from a sowing of 2,500 acres as against 8,500 bushels from 2,500 acres the previous year, and 45,000 bushels from 2,400 acres in 1968–69.

Hay. — Production was 1,000 tons, a decrease of 850 tons on the previous year. The reduction was due mainly to lack of spring rains at Trangie.

Silage. — 200 tons were produced, compared to 560 tons in the previous year.

Fodder transfers and reserves. — Dry conditions in the latter part of the year resulted in an increased demand for fodder, which was satisfactorily met from reserves. Approximately 25,000 bushels of grain and 350 tons of hay was transferred within the Department for feeding livestock.

In addition, 8,000 bales of lucerne hay produced at the Agricultural Research Station, Trangie, was donated to the State Flood Relief Committee after the January-February floods.

Fodder reserves at research stations consist of 130,000 bushels of grain and 3,000 tons of hay, with a current market value of approximately \$300,000. In addition, 3,000 tons of silage are on hand.

1971 Winter cereal sowings. — The sowings this year totalled 2,500 acres; 200 less than in the previous year, due mainly to poor soil moisture conditions at sowing time.

Livestock

Although conditions were dry in much of the state in the latter part of the year, they were better than in the previous year.

Stock numbers on research stations (excluding Agricultural Colleges) at June 30, 1971 were: cattle (dairy and beef — all types) — 2,142; sheep (all types excluding lambs) — 2,208; pigs (all types) — 229; poultry (pullets, hens, cockerels, broilers and turkeys) — 14,300; horses — 44; and goats — 23.

EXTENSION

EXTENSION FROM RESEARCH STATIONS

Research station managers were active in extension work, relating to both research and to the general activities on the stations. Public interest in research stations and their operation continued to be very high. Excellent co-operation was provided by press, television and radio stations.

Field days and/or open days were held on six stations with attendances as high as 250 at Bathurst and 400 at Wollongbar.

Farmers' organizations appeared to be looking to research stations more than ever for guidance in such matters as alternate forms of production. There has been a steadily increasing call for assistance from high schools with field excursions; limits have had to be placed on the commitment in this direction on at least one station.

All research stations had a steady, continuing flow of local, interstate and overseas visitors and a considerable volume of telephone enquiries.

EXTENSION IN AGRICULTURAL ENGINEERING

Projects

Agricultural Machinery Officers undertook planned extension projects relating to the problems and needs existing in their respective regions. The projects concerned almost every type of agriculture and farm machinery.

Mass Media

Radio. — Agricultural Machinery Officers made 173 separate recordings for radio broadcast. Many recordings were used by as many as 5 radio stations. To ensure that the whole state received some extension coverage on agricultural machinery, the Senior Agricultural Machinery Officer visited regions in which no Agricultural Machinery Officers were located and prepared radio recordings.

Press. — In addition to the 46 individual press statements issued to country and city press, special items were prepared for newspaper supplements.

Schools

The 14, one-day schools for farmers included: 4 schools on oxy acetylene welding; 3 on bushfire machinery; 2 on farm machinery maintenance; 2 on controlled atmosphere storage; 1 on flood forecasting; 1 on bore screens; and 1 on design of farm machinery.

Field Days

Agricultural Machinery Officers organized or participated in 25 field days covering a wide range of subjects such as mechanics and problems of fodder rollers, farm grain storage, sprayer usage and maintenance, grain drying, grain screening, potato harvesting, potato planting, onion harvesting, rice harvesting, cultivating machinery, row crop planters and farm mechanisation.

The Agricultural Machinery Officer, Orange, played a major role in the organization of the Annual Australian National Farm Machinery Field Days held at Orange. This officer has built up a reputation for his competence in major field day organization. The work he undertakes for the Australian National Farm Machinery Field Days has immense extension value throughout the state. Despite the rural recession, the number of exhibitors at Orange was as high as usual (about 190), and the number of visitors was higher than usual (28,900).

On the North Coast, the Agricultural Machinery Officer played a prominent part in organizing a four-day "North Coast National Agricultural and Industrial Exhibition" at Lismore in October, 1970, (attendance 15,000) and a two-day "Farmarama" farm machinery field day at Lindendale in May, 1971 (attendance 1,000). These field days provided comparative demonstrations of farm equipment used on the north coast.

Lectures

The 58 lectures at meetings, conferences, schools and seminars, related to calibration of boom sprayers, tractor maintenance, controlled environments in primary industries, harvesting oil seed crops, mechanics of fodder rollers, flood forecasting, permanent electric fencing, cultivation machinery, grain drying, grain aeration, grain screens, farm mechanisation, machinery selection, rice harvesting, high speed analysis and controlled atmosphere storage of pome fruit, design of tillage equipment and manufacturing problems of agricultural machinery.

Tours

The Agricultural Machinery Officer in the North Western Region conducted 20 farm tours to show groups of farmers methods of adapting and using various items of equipment. Farm tours are a valuable extension method as they allow small groups to study the implementation of new ideas in situ and discuss them in relation to their own requirements.

Duplicated Notes

Duplicated notes were prepared on 17 topics for distribution in support of lectures and demonstrations or in answer to enquiries.

Liaison with Industry and Machinery Manufacturers

Agricultural Machinery Officers maintained close liaison with industry and machinery manufacturers to ensure that new machinery introduced to the various regions was suitable. This close liaison, built up over a number of years, has resulted in manufacturers being prepared to discuss the design of new and prototype machinery before its introduction to the market. In many instances improvements have resulted.

During 1970-71 the agricultural machinery trade experienced probably the worst economic period since World War II. Some distributors sold less than 25 per cent of their normal machinery turnover. Agricultural Machinery Officers visited most dealers in their region at least once advising them of farmers' specific requirements in an effort to ensure that they are not overstocked with equipment unsuitable for their areas. They also encouraged dealers, wherever possible, to keep service

staff employed. There has been a drift of good servicemen to the city. This will present a serious problem for landholders unless young farm mechanics are trained in country towns to service the sophisticated equipment now on farms.

Dealers and farmers were also encouraged to give more attention to off season maintenance. Lack of off season maintenance has been a weakness in farmers' repair and maintenance programmes. Present indications are that landholders are repairing their old equipment and making it do rather than purchasing new equipment.

Some Extension Highlights

Grain drying. — The Agricultural Machinery Officers at Leeton and Gunnedah made progress in introducing improved grain drying techniques. Following earlier work done at Gunnedah to speed up drying rates, the Agricultural Machinery Officer has worked in association with local manufacturers and used information from American university literature. He introduced a radial flow-type dryer with a drying capacity of up to 30 tons per hour, reducing the moisture content of the grain by 4 per cent. 30 of these dryers are now reported to be in use.

In the South Western Region, the Agricultural Machinery Officer co-operated with the Irrigation Research and Extension Committee to form a Grain Drying Sub-Committee. This Committee is investigating the grain drying requirements of the Region with the view to recommending the most suitable types of dryers for both farm and contract drying.

Rice Header Demonstration. — A rice header demonstration for farmers, manufacturers and dealers was conducted again this year in conjunction with the Rice Header Appraisal Committee of the Rice industry. A dense and partly-lodged crop proved to be too difficult for at least two of the five headers demonstrated. The demonstration clearly indicated that some headers are not capable of harvesting rice under difficult conditions. Each header was individually appraised and a report prepared for distribution to rice growers and the participating header manufacturers. This demonstration assisted farmers in selecting headers and assisted manufacturers by showing them where improvements were possible.

Controlled atmosphere storage. — High interest by farmers demanded further extension work on controlled atmosphere storage of fruit. The Agricultural Machinery Officer at Orange and Wagga assisted farmers to solve practical problems encountered in using this method of storage. Most problems resulted from farmers failing to take the advice previously given. Despite lower market returns for fruit, orchadists realise that it pays to improve quality of fruit and that storage costs can be reduced greatly by using the C.A. storage methods developed by the Department. Cool stores providing space for approximately 125,000 bushels in controlled atmosphere were built during the year.

Tomato and onion harvester work groups. — Work groups were formed on the M.I.A. to determine the types and designs of machines required for tomato and onion harvesting and to advise machinery manufacturers accordingly. The groups are sub-committees of the Irrigation Research and Extension Committee and include officers of the Department and C.S.I.R.O. and farmers. They are enabling the ideas of practising farmers and officers of the Department to be consolidated in a form suited to the machinery manufacturers. Formation of the work groups followed detailed investigations by the Agricultural Machinery Officer and they are largely guided by them.

RESEARCH AND INVESTIGATIONAL WORK

AGRICULTURAL ENGINEERING CENTRE

The Agricultural Engineering Centre, the first of its kind in Australia, was established during the year, following the completion of the new buildings in December, 1970 and the employment of staff of two professional engineers, a manager, a draftsman, two fitter and turners and one office assistant.

The purposes of the Centre are firstly, to conduct research with the object of improving the mechanisation of agriculture particularly in those industries which are not adequately catered for by large manufacturers and, secondly, to construct prototype sophisticated machinery and instruments for use by the Department's research workers.

Development of a Tomato Harvester

At the request of the Irrigation Research and Extension Committee on the Murrumbidgee Irrigation Area, the Centre undertook the development of a low cost tomato harvester suitable for local conditions. Machines imported from the United States cost about \$30,000 and are beyond the means of M.I.A. farmers. Local canneries are concerned that, without mechanical harvesters, difficulties with labour for harvest may limit supplies of tomatoes for processing.

A potato harvester was modified, tested and re-modified by the Engineering Centre. The front-end harvesting assembly and pick-up mechanism have developed to a satisfactory stage. The shaking mechanism still needs design changes. However, it is now considered that it will be possible to develop a satisfactory low-cost tomato harvester for local production.

Pasture Drill

Research workers have required, for some time, an experimental pasture drill that is suitable for sowing small plots with accurate quantities of seed and fertilizer and is easy to clean between plots. The Engineering Centre designed and built a small pasture drill which was delivered to Condobolin for the sowing of trials in 1971.

The machine has separate cone-type metering devices for seed and fertilizers. It has seven tynes spaced on two adjustable tool bars at the front for fertilizer placement and two more rows of tynes at the rear for seed placement. This arrangement allows separate banding of seed and fertilizer, and the relative position of the bands can be varied as required by repositioning the tynes. The machine is primarily designed for sowing a small amount of seed over a plot 1 metre wide and 20 metres long, although the plot length is adjustable. The seed and fertilizer is pre-weighed into containers and sowing can be a continuous operation.

Grain Drying

The upper temperature limits for drying various grains is a matter of some contention. In tests at the Centre, grain sorghum is being dried over a wide range of temperatures. A small grain dryer was designed and manufactured to represent a portion of a wall section of a commercial radial flow dryer. Air flow can be regulated, temperature can be varied and the temperatures of the grain in different layers can be measured by means of thermocouples. Samples of the dried grain will be fed to chickens at Seven Hills Poultry Research Station to determine the effects of high drying temperatures on the nutritive value of the grain.

In association with the Electricity Authority of N.S.W., two drying tests were conducted on a radial flow-type grain dryer on a farmer's property at Quirindi. The results have been important in establishing drying rates for this type of dryer and the rates are now being adopted throughout the State.

Orchard Spraying

In association with the Agricultural Machinery Officer, Orange, the Division of Horticulture and the Biological and Chemical Research Institute, a spraying trial was conducted at Orange to determine the effectiveness of commercial airblast spray machines in controlling two spotted mite. The results are reported by the Division of Horticulture.

Hay Handling

The bulk handling of half bales of hay from the baler (or paddock pick-up) to the stack, as carried out in the United States and Europe, is being studied. Design work on the trailer, hopper and conveyor has been completed and the equipment is on order.

Experimental Tobacco Curing Kiln

A small tobacco curing kiln was designed by the Centre and is being constructed for use by tobacco research agronomists at Glen Innes. The kiln, which has relative humidity and temperature control at selected levels within the ranges required for tobacco curing, is designed to give accurate control of temperatures and humidity in curing. Apart from the use of the equipment for experimental work, the principles used and data obtained will assist manufacturers to improve designs of tobacco curing kilns.

Grain Aeration

A project in association with officers of the Biological and Chemical Research Institute was designed to determine the effects on insect numbers of aerating grain in silos. Although results indicated that aeration increases the life of the malathion, a considerable number of insects still remained in the top surface and at the outlets of the silo. Aeration did not produce sufficient improvement in insect control to justify its recommendation for small farm silos storing grain at approximately 10 per cent moisture content.

Controlled Atmosphere Storage

Work continued on the project on controlled atmosphere (C.A.) storage of fruit. Further improvements were made to the plastic room and the open flame generator system developed over the last two years in conjunction with the Division of Horticulture.

An air circulation system to enable fruit to be pre-cooled in the plastic room was designed and incorporated in four new plastic rooms and several existing plastic rooms. The cooling rates were quite satisfactory, and the need to pre-cool the fruit in another room was thus eliminated. An improved floor system was also developed and used successfully in five new rooms at Orange.

Controlled Environment Storage Room for Bananas

A controlled environment room with controlled temperature and humidity as well as the optional use of controlled atmosphere was designed and built for the Division of Horticulture. The unit will allow storage work to be carried out on other fruits and vegetables when the banana research programme has been completed. The unit should also provide valuable data for the design of future facilities for fruit and vegetables storage research.

RESEARCH BY AGRICULTURAL MACHINERY OFFICERS

In addition to the research at the Agricultural Engineering Centre, research projects were conducted by Agricultural Machinery Officers stationed at regional offices of the Department.

Efficiency of Rice Harvesting

The Irrigation Research and Extension Committee donated a rice header valued at \$11,000 to the Department, to be used in conjunction with the high speed analysis equipment donated in the previous year, to investigate the reasons for high losses of rice grain during harvest.

Films were made to analyse the passage of rice through various parts of the rice header in an effort to determine why flow of the crop through the header is uneven when harvesting in both normal and difficult conditions. The data from the films will be critically analysed to determine the cause of the problems. The information will then be made available to header manufacturers.

Mechanical Harvesting of Tree Fruits

A locally-made mechanical tree shaker was acquired by the Department in February, 1971 and used to harvest 10,000 lb of prunes. Fruit remaining on the trees after mechanical harvesting ranged from 2 to 20 per cent. Damage to the trees appears, on evidence available at this stage, to have been slight. Modifications are planned to improve the performance of the machine and variations in the pruning technique should assist in minimising damage to the fruit. Operators will need training to use the machine effectively. The machine will be used on peaches and apricots next harvest.

Settings for Wheat Harvesting Machines to Handle Other Crops

Information was collected about the settings and additional components that are necessary on headers to handle field peas, lupins, rape, sunflower, soya beans and buck wheat and the relative merits of open front headers and maize front harvesters for use in harvesting maize are being appraised.

Electric Fencing for Control of Dogs

An experiment conducted in conjunction with officers at the Cattle Tick Research Station showed that electric fences are not practicable for the control of dogs.

Seed Sizing of Potatoes

A trial showed that grading potatoes for size prior to planting improved the performance of automatic mechanical planters which are now being used in increasing numbers.

Multi-row Bed Planting of Carrots

A trial rig was constructed by the Agricultural Machinery Officer to evaluate mechanical problems associated with multi-row bed planting of carrots. The rig proved satisfactory for sowing. It was also used for planting a soya bean trial at Leeton Agricultural Research Station. However further work is necessary to develop this concept as many agronomic problems were encountered during the growing period.

Mechanical Harvesting of Onions

A prototype machine, developed by the Agricultural Machinery Officer in the South-Western Region, removes dead and living weeds from each side of the hill encouraging the quick curing of onions and facilitating harvesting.



A locally-developed grape harvester being used to harvest sultanas dried on the trellis. Shortage of casual labour and increasing wages have encouraged development of mechanical harvesters for fruit. The Department has imported a mechanical prune harvester for testing.

Damage to Potatoes in Washers and Graders

An investigation was made to determine where damage occurs in the process of washing and grading potatoes. The average proportion of tubers damaged by washing and grading plants was 6.6 per cent but there was wide variation. Spray plants with careful operation damaged only 3 per cent, whilst damage in drum washers in some cases was as high as 11 per cent. Tipping damage from bulk bins averaged 5 per cent due to bad tipping techniques, sharp edges, bad design of bin hoppers, bad designs of flow onto elevators, elevator speeds and bar coverings.

Rice Threshing Table for Asia

Assistance was given with the testing of a rice threshing table for use in Asian countries. The initial design prepared by the International Rice Research Institute in Manilla was modified to suit commercial production by a Sydney firm. Agricultural Machinery Officers also assisted in the production of a film to show the operating principles of the thresher. The thresher and the film were later shown at a trade fair in Indonesia.

Potato Handling System

A design for the construction of a potato handling system capable of processing 15 tons per hour was produced for a large potato grower in the Orange district.

ADMINISTRATION OF DROUGHT RELIEF

The administration of drought relief is a responsibility of the Division of Research Stations, whose Chief is the Chairman of the Inter Departmental Committee on Drought Relief (Standing Committee on Drought Relief).

The drought position in July, 1970, was such that 13 Pastures Protection Board Districts, or portions of Districts were declared drought stricken. The situation worsened until September, 1970, when more than half the state was drought declared. Good rains then improved this position, and by May, 1971, only one district (far south-west) of the state was drought declared. However, conditions were deteriorating towards the end of the financial year when a number of districts were on the verge of being drought declared.

The question of drought relief, and the formulation of a uniform drought relief policy throughout Australia following the declaration of drought areas, received considerable attention during the year. An integral part of drought relief was the provision of Commonwealth financial assistance.

The State Government approved of a basic drought relief scheme in principle, subject to satisfactory financial arrangements being made with the Commonwealth. An approach now will be made to the Commonwealth Government seeking financial assistance to implement the scheme.

The Australian Agricultural Council considered including natural disasters other than drought that affect rural industries, namely flood, bushfire and cyclone, in an overall Commonwealth-State uniform natural disaster aid scheme.

PUBLIC WATERING PLACES IN THE WESTERN DIVISION

Maintenance and improvement of the Public Watering Places in the Western Division continued at a similar rate to previous years with an expenditure of approximately \$90,000. Maintenance and improvement expenditure for the last six years now aggregates \$660,000.

Most major stock routes are now provided with adequate watering facilities and are in a better condition than they have ever been in the past. The provision of adequately maintained stock routes could prove to be of greater importance in the future because increased stock movements on travelling stock reserves are expected to result from the recession in the sheep industry.

As reported under the heading "staff", the staff of the Western Division Public Watering Places has been re-organized but there have been difficulties in obtaining suitable staff.

New Works

Some of the major new works in 1970-71 were the excavation of three new tanks on the Darnick-Pooncarie Travelling Stock Route (\$16,500), new bores at Eureka Well (\$2,500) and Murtee (\$3,000), the erection of stockyards at Wanaaring (\$2,500), and installation of mill, piping, troughing and a 20,000 gallon tank at Weinteriga Bore (\$3,900). Two new three-berth caravans (\$3,000 each) were purchased for use by the maintenance gang at the Supervisor's Depot, Cobar.

Maintenance Work

Maintenance work included desilting and reconditioning Bulla Bulla Tank (\$4,500), construction of a by-wash at Double Tanks (\$5,900) and the replacement of an unserviceable 20,000 gallon reserve tank at Warrego Bore (\$1,000).

SAFETY

The Agricultural Engineer is a member of the Executive Advisory Committee for Safety in Rural Industries and serves on its Rural Safety Promotions Committee. This work comes under the control of the Department of Labour and Industry. Draft safety regulations have been amended following a public review and have had limited re-circulation for further comment.

The Agricultural Engineer is also a member of the Intra-Departmental Committee on Occupational Safety and Occupational Health.

Agricultural Machinery Officers have participated at four seminars on rural safety organized jointly between the Departments of Agriculture and Labour and Industry. The officers at Wagga and Orange have impressed upon operators of controlled atmosphere cool stores the dangers on entering stores soon after opening due to the low level of oxygen. Operators have also been warned of the risk of a build-up of carbon monoxide when engine-driven fork-lift trucks are operated in cool stores for lengthy periods.

In a concentrated effort to improve the work safety situation on the Department's research stations, the 1969 Biennial Conference of Research Station Managers took as its theme "Safety in Rural Industries". The Conference served to make the research station managers aware of the need for a planned work safety effort on their respective stations. The Department's Safety Officer made systematic inspections and reports on the research stations which resulted in a marked improvement in work safety.

Examples of improvements in work safety included enforcement of the use of guards on power take-off shafts, enforcement of the use of seat belts in motor vehicles, provision of guards for drive belts and pulleys, disposal of old and unsafe equipment, use of face guards whilst using grinding wheels, regular servicing of fire extinguishers and installation of adequate first-aid facilities.

In addition procedures were adopted in connection with injuries on research stations in which managers complete reports indicating the cause of the accident and stating the action taken to prevent the occurrence of similar accidents.

The Department is continuing with its effort to ensure that work safety on the research stations remains at a high level. The presentation of an Annual Safety Award is being considered as an added incentive.

DIVISION OF PLANT INDUSTRY

GENERAL

Professional Staff

Senior staff changes. — Senior appointments made during the year were: Mr F. W. Cutting to Principal Agronomist (Miscellaneous Crops), Mr R. Claxton to Assistant Principal Agronomist (Miscellaneous Crops) vice Mr Cutting, Mr E. C. Darley to Principal Agronomist (Vegetables), Mr R. I. Johnson to Assistant Principal Agronomist (Extension) vice Mr Darley, Mr A. D. Mears to Assistant Principal Agronomist (Research) and Mr G. McMaster to Assistant Principal Agronomist (Weeds) vice Mr Mears.

Professional staff establishment. — The Division of Plant Industry began the year with 176 established positions of which 7 were vacant. At the end of the financial year the total number of established positions remained unchanged at 176 with 6 vacant. The vacancies are two head office positions, two research positions, one district agronomist position and one agronomist-in-training-for-extension position.

During the year, four officers returned from National Service training, eight resigned and five were transferred to other sections or Divisions of the Department. Ten graduating trainees were appointed to the Division, five for research and five for extension.

At June 30, 1971, the Division had 26 positions in head office, one of which was supernumerary, and 150 in rural areas. Of these 150 positions, 75 are in research, 74 in extension, and one is administrative.

Whilst four new positions were created, four were deleted. Of the new positions, one was financed from Australian Wool Board funds and the remainder from Consolidated Revenue. The four positions created were: District Agronomist, Singleton; Agronomist seed production research, Agricultural Research Station, Tamworth; Agronomist, aerial pasture improvement research, Orange; and Agronomist, galvanised burr research, University of Sydney (Australian Wool Board Funds).

The four positions deleted were: Agronomist (supernumerary), Agricultural Research Station, Tamworth; Agronomist, pasture research, Agricultural College and Research Station, Yanco; and two positions of Agronomist, tobacco research, Agricultural Research Station, Glen Innes (Tobacco Industry Trust Account Funds).

Effect of Industry Funds on Research

Industry research funds continued to provide valuable support in maintaining research programmes. Grants were applied towards payment of the salaries and travelling expenses of 20 research agronomists and 24 field and laboratory staff. They also allowed the purchase and maintenance of capital items and operating costs for various research projects.

As rural trends resulted in limitations on the availability of some Industry Funds, applications for support were modified accordingly. However, the termination of three training programmes enabled requests to be made for support for new areas of research.

Major sources of funds were: Wheat Industry Research Committee, \$81,000; Australian Meat Research Committee, \$58,000; Wool Research Trust Fund, \$156,000; Tobacco Industry Trust Account, \$56,000. These funds, which provide a total of \$351,000, supported a large segment of the agronomic research undertaken. Financial and other support from groups of farmers and research and extension organizations was also valuable.

Employment of Commonwealth Extension Services Grant Funds

Commonwealth Extension Services Grant funds made a significant contribution to the Division's activities. Salary and expenses of four research and seven district agronomists were met from this source. Over \$8,000 was expended on equipment and facilities for research into biscuit wheats under irrigation, soybeans, pastures and irrigation. In addition, \$5,000 was used for demonstrations of improved practices with pastures, forage crops and weed control and \$4,000 for the cost of attendance of officers at national and state research conferences.

Research Publications

The communication of research results to other research and extension workers as well as to producers received added impetus through an officer being given specific responsibility for processing publications. This has already resulted in a marked increase in the number of papers published. Moreover for the first time, the annual technical reports of research agronomists were combined in a single bound document available for use within the Department.

Changes in Research Emphasis

More emphasis was placed on agronomic research with new crops as alternatives to wheat in response to the changing needs of primary producers. One new appointee is working wholly on rapeseed and grain legumes, while three experienced research agronomists have sharply reduced their pasture research programmes in favour of work on new crops.

All the Division's research projects were reviewed. Many old projects were terminated. Others are being redefined to clarify objectives and set time limits for their conclusion. Particular attention has been paid to pasture research projects to ensure that resources are channelled to the most urgent work.

Post Graduate Study and Training

Research agronomists. — At June 30, 1971, five research agronomists were engaged in Ph.D. studies at Australian and U.S.A. Universities.

There were six research agronomists on secondment to the CSIRO at Canberra, Armidale and Griffith for training and co-operative research with forage and fodder crops and irrigation. One research agronomist was on secondment to the University of New England to investigate the control of bloat in cattle through pasture management and one to Macquarie University where he was developing a mathematical model incorporating the factors influencing the growth and development of wheat. Two research agronomists are at the Universities of Sydney and New England respectively for weed research.

All officers working with other institutions had registered their work for higher degrees and 25 research agronomists were registered as masterate students at various universities in N.S.W.

Doctorate of Philosophy studies were completed by two officers and they returned to duty. Dr D. J. McDonald returned to Yanco, and Mr M. H. Campbell, whose thesis was being examined, returned to Orange. Mr E. C. Wolfe, still seconded to the University of New England, had also submitted a Ph.D. thesis.

Extension agronomists. — Six district agronomists and two agronomists-in-training were undertaking External Degree Courses — three at the University of New England and five at Macquarie University.

At the first post-Diploma course held at Hawkesbury Agricultural College in 1970, three district agronomists gained their Diploma in Rural Extension; three others were accepted for the 1971 course.

Training for District Positions

There were 21 extension agronomists-in-training for district appointment. Of these, two were receiving advanced training in regions as the final step prior to appointment to a district and one was on National Service.

Programme Planning

For research. — Programme plans for the year 1971–72 have been developed for each research agronomist's work based on a review of the extent to which plans for 1970–71 were achieved. The formal programme planning concept has been increasingly accepted by research agronomists and has been used more by administrators in reviewing research.

For extension. — Programme planning, initiated three years ago, continued to play an important part in the activities of district agronomists who were well established in their districts. However, 15 of the 48 district agronomists had been in their present locations for less than two years. Their ability to prepare well considered programmes was consequently limited.

The economic difficulties of many agricultural industries posed a challenge in the formulation of extension programmes to meet each situation. In many instances the challenge was met by incorporating extension activities aimed at developing knowledge of, or promoting the production of, crops which formerly were not widely grown. In other instances, co-operative planning by district agronomists and officers from other disciplines, including livestock extension officers, was adopted with mutual advantage.

Some Statistics of District Agronomists' Activities

District agronomists worked an average of 226 days comprised of 92 days in their offices; 21 days at conferences and schools; and 113 days in the field, which included advisory work on pastures and crops, conduct of experiments, field days, land settlement and farm water supply inspections, seed production matters, farm competitions and show judging.

District agronomists conducted an average of 5.5 field days or schools per district with a total attendance for the state of over 9,200 people, an average attendance of over 40 per occasion. The average number of meetings per district was 5.4 with a total attendance of over 6,000 and an average attendance of 28 per meeting. District agronomists provided an average of 23.6 radio sessions and 17.5 publicity statements. They made a total of 29 television appearances. The averages quotes are from the 38 districts which were staffed by the one officer for the full twelve months. Totals include the activities in the districts where new agronomists were appointed or where agronomists spent long periods at in-service courses.

The volume of mass and group extension activities was slightly lower than in the previous year. The decrease reflected the numerous staff changes, the tendency of farmers to avoid change in periods of financial difficulty and the unfavourable season. The decrease would have been more severe but for the increased interest in new crops as alternatives to wheat.

Co-operation with Other Departments

District agronomists assisted other departments and instrumentalities. During the widespread floods in December 1970 and January 1971, district agronomists played a most important part in civil defence activities as well as in assisting the agricultural community. Acknowledgement of their outstanding service was received from other departments and local government organizations. After the floods receded, district agronomists investigated and reported on a large number of claims for flood relief.

The Principal Agronomist (Extension) was appointed to the inter-Departmental Flood Relief Committee to administer the Commonwealth-State Flood Relief Scheme.

Co-operation with many other departments included property inspections in connection with: applications for advances under the Farm Water Supplies Act; Authorities to Enter and Prospect under the Mining Act; and compensation claims by property owners for disturbance by a number of departments during their normal functions.

Plant Exchange

There were 51 seed introductions from overseas sources and 39 samples were sent to other countries.

CEREALS

WHEAT

Acreage and Production

Preliminary figures for the 1970–71 season indicate that 5,500,000 acres of wheat were sown for a production of 111,000,000 bushels at an average yield of 20.2 bushels per acre. The acreage was significantly less than in the previous year due mainly to further reduction in wheat delivery

quotas and protracted dry weather in many parts of the north west. In contrast to the dry sowing period, prolonged rain during harvest, especially in the north west, resulted in much grain being reduced in quality.

Deliveries to the Wheat Board totalled 97,000,000 bushels consisting of: F.A.Q. 55,100,000 bushels; N.S.W. prime hard 12,800,000 bushels; Northern hard 3,000,000 bushels; N.S.W. hard — segregated Falcon 1,100,000 bushels; soft biscuit premium wheat 1,500,000 bushels; Northern weather damage 12,100,000 bushels and N.S.W. off-grade 11,400,000 bushels. The remainder of the wheat produced in N.S.W., about 14,000,000 bushels, was retained on farms for seed or feed or disposed of outside the operations of the Wheat Board.

The final wheat acreage for the 1971–72 season is uncertain because of prolonged dry weather especially in northern and upper central areas.

Premium Wheats

Local flour millers paid premiums on a total of 5,134,600 bushels of wheat grown in the 1970–71 season. In the previous season premiums were paid on only 2,028,320 bushels.

Premiums for grain of selected wheat varieties, contracted by mills direct with growers to May 17, 1971, reached \$147,000 for 2,134,600 bushels — an average of 6.89 cents per bushel. The premiums were made up of: \$51,282 on 540,804 bushels of hard bread wheat varieties (av. — 9.47c); \$32,791 on 180,449 bushels of the Department's durum variety Dural, not including a small quantity of the new durum variety Duramba which was delivered as seed (av. — 18.17c); and \$63,022 on 1,413,300 bushels of soft wheat varieties (av. — 4.45c). In addition to these quantities local millers contracted to pay a premium on a further 3,000,000 bushels of prime hard wheat from the bulk premium pool.

Highest average premiums per bushel for individual varieties were paid for Dural (18.17c) and the hard bread wheat varieties Windebri (10.3c) and Timgalen (10.2c). Best average premium for soft varieties was for Pinnacle (4.8c).

The most popular hard bread wheat varieties, gauged by quantities accepted for local premiums, were Timgalen (50.9 per cent), Gamut (20.5 per cent), Mendos (13.1 per cent), and Falcon (9.2 per cent). The three varieties Pinnacle (83.5 per cent); Bencubbin (8.3 per cent), and Insignia (3.2 per cent) accounted for 95 per cent of the soft variety deliveries for which local premiums were paid.

In addition to the above quantities on which mills contracted to pay a premium, a further 9,000,000 bushels of prime hard wheat tested for protein were received at selected receival points for sale to overseas buyers.

Wheat Quality Standards

For the 1970–71 harvest seven standards were declared by the New South Wales F.A.Q. Standards Committee: N.S.W. prime hard, Northern hard, Northern F.A.Q., Northern weather-damaged, N.S.W. hard (Falcon), South-Western F.A.Q., and N.S.W. off-grade.

The standard for 12,800,000 bushels of *N.S.W. prime hard* wheat (mainly from northern N.S.W.), was declared at 63 lb per bushel (14.4 per cent protein). Other standards were declared as: *Northern hard* — 3,000,000 bushels, 63 lb per bushel (12.9 per cent protein); *Northern F.A.Q.* — 1,700,000 bushels, 63 lb per bushel (10.9 per cent); *Northern weather-damaged* — 12,100,000 bushels, 58 lb per bushel (13 per cent protein); *N.S.W. hard (Falcon)* — 1,100,000 bushels, 63 lb per bushel (11.5 per cent protein); *South-Western F.A.Q. delivered to N.S.W. Grain Elevators Board Stations* — 50,200,000 bushels, 62 lb per bushel (10.8 per cent protein); and, *N.S.W. off-grade* — 11,400,000 bushels, mainly from the south-west, 59 lb per bushel (11.2 per cent protein).

Weighings were made on the official Schopper scale which normally records weights of up to 1½ lb higher than those on the Franklin Chondrometer.

For comparison, in the previous season (1969–70) N.S.W. prime hard wheat was declared at 62½ lb (14 per cent protein); Northern hard 62½ lb (11.9 per cent protein); Northern weather-damaged 59 lb (12.8 per cent protein); South-Western F.A.Q. 63 lb (11.1 per cent protein); and N.S.W. off-grade 60 lb (11.1 per cent protein).

Overall, apart from the weather-damaged wheat, the quality of the grain received was good.

Popularity of Wheat Varieties

Variety statistics for the 1969 season show that Heron maintained its position as the leading variety in the state, a position it has held since 1963. The greatest change in popularity was in the case of Timgalen which rose from eighth position in 1968 (3.7 per cent) to second place (12.1 per cent) in 1969. Robin also increased rapidly in area from 1.1 per cent in 1968 to 5.5 per cent in 1969–70. The varieties Falcon, Gamenya and Gamut declined most in area, with smaller decreases for Mendos and Festiguay.

Wheat Variety Recommendations

The newly-named variety Eagle (previously known as AR Falcon 28A) was added to 1971 sowing recommendations in central and southern dryland areas where Falcon was previously recommended. Eagle is a hard-grain variety and is resistant to rust. Falcon will be retained in recommendations for the time being.

Gatcher, a rust resistant hard grained variety bred by the University of Sydney was added to the recommendations as a replacement for Mendos in the main northern wheat growing area. Mendos has been deleted from all recommendations.

Duramba, a semi-dwarf durum (macaroni) variety bred at Tamworth Agricultural Research Station was added to the recommendations for fertile soils of the northern wheatbelt in areas where Dural is at present recommended.

Summit, bred by the Victorian Department of Agriculture, was added to the recommendations for central and southern dryland areas as a replacement for Pinnacle.

Festiguay, which has become more rust susceptible, was deleted from irrigation recommendations in northern N.S.W. and on the Murrumbidgee and Coleambally irrigation areas.

Spica was added to recommendations in the main rust-labile areas of the Western Agricultural Region.

A study of official statistics showed that wheat growers in N.S.W. are following official variety recommendations made by the Standing Advisory Committee on Wheat more closely. Comparisons were made for each of the Department of Agriculture Regions on which variety recommendations are based.

For the whole state, 81 per cent of the total area sown to wheat in 1969–70 was under recommended varieties. This compared with 70 per cent in 1967–68, 56 per cent in 1962–63, and only 50 per cent in 1960–61.

The proportions of the acreage sown to recommended varieties in the various regions in 1969–70 were: Northern – 84 per cent; North Western – 81 per cent; Western – 78 per cent; Mid Western – 87 per cent; Southern – 80 per cent; and South Western – 77 per cent.

Durum Wheats

The possibility of expanded export markets for durum wheats was opened up by registration of the Department's new wheat variety Duramba and its inclusion in recommendations for 1971 plantings in northern N.S.W. The Australian Wheat Board is showing increasing interest in this type of wheat.

Following the first overseas shipment to Kuwait of grain of the Dural variety in 1969, the Wheat Board arranged a further shipment during 1970, and has accepted a firm reservation for a shipment from the 1970–71 harvest.

A special quota for two million bushels of durum wheat was allocated to N.S.W. for the 1971 sowing season, and all durum wheat sown in 1971 was grown under contract conditions with licences issued by the Wheat Board. The Premium Wheatgrowers' Association, in conjunction with the Board, contracted with growers for the sowing of 10,000 bags of Duramba seed, sufficient to plant approximately 60,000 acres. The objective was to produce 1,500,000 bushels of grain for expanded local and export use.

In 1970, durum wheats were grown on 9,200 acres for a total production of 211,450 bushels. Dural produced 178,450 bushels from 7,730 acres and Duramba 33,000 bushels from 1,470 acres.

Wheat Quality Assessment

The Chemistry Branch co-operated in the quality assessment of new varieties under test on research stations and on co-operating farmers' properties. Approximately 800 samples were supplied for testing. In addition, Uniform Quality Testing of a number of promising crossbreds was carried out by collaborating laboratories. Following tests on the crossbred Tamworth 221 it was decided to propose to the State Wheat Improvement Committee that this variety be submitted for registration. Registration would allow its inclusion in recommendations for 1972 sowings in northern N.S.W. as a replacement for Festiguay. Depending on final yield and quality tests, one or more other lines may later be considered for release.

Wheat Experiments – Variety Trials

During the 1970–71 season randomised and replicated wheat variety trials were arranged with 97 farmers (106 in 1969–70) working under the supervision of 29 (30) district agronomists and testing a total of 26 (23) varieties. In addition, wheat variety trials were conducted on seven research stations where a large number of promising crossbreds and new varieties were tested in comparison with standard varieties.

A number of trials could not be sown because of prolonged dry weather and some trials failed because of insufficient moisture during the growing season. Very wet conditions at harvest destroyed some trials. The number of trials harvested was 108 compared with 130 in 1969–70.

Performance of New Wheat Varieties

In northern N.S.W. new varieties under test included Gatcher, Eagle, 8127–266, Tam. 221 and Tam. 237.

Gatcher, a rust-resistant variety of the prime hard class bred at the University of Sydney's Narrabri Wheat Research Institute, yielded better than Festiguay, similarly to Gamut and Timgalen but less than Gamenya.

Eagle, a rust-resistant variety bred at Temora Research Station, yielded much better than Festiguay and Gamut, and similarly to Timgalen, Gamenya and Gatcher.

The Tamworth crossbred 8127–266 performed very well in trials, being superior overall to Festiguay, Gamut, Timgalen, and Gatcher and equal to Gamenya. However the future of this crossbred is in doubt because of a tendency to low protein content and overstable dough quality.

The two Tamworth crossbreds 221 and 237 are of semi-winter and winter habit respectively; 221 is designed to replace Festiguay and 237 to replace Winglen and Windebri. Both lines performed well in comparison with the standard varieties.

In central and southern N.S.W. new varieties tested included Eagle, M1224–2, Glaive, Gatcher, Darkan and Halberd.

Eagle did not yield as well as Falcon because of the dry winter and early spring but its rust-resistance was maintained. Overall results show that Eagle is equal to or better than Falcon in average or better-than-average seasons but tends to be lower in yield in below average seasons.

M1224–2 performed better than Olympic overall mainly on account of a greater resistance to *Septoria tritici*.

Glaive performed well in comparison with standard varieties during the season but its yield performance over several seasons shows it to be inferior to varieties such as Falcon, Eagle and Robin.

Gatcher was tested for the first time in central and southern districts but gave a mediocre performance in comparison with Eagle and Gamenya.

Darkan and Halberd, two new introductions from Western Australia and South Australia respectively, yielded much better than Robin and Eagle. They require further testing to confirm results obtained in 1970.

Irrigated Wheat Research

Trials with irrigated wheat continued on the Murrumbidgee Irrigation Areas.

Gypsum was shown to be of no economic advantage for wheat on most soil types of the MIA in trials concluded in 1970. In 1969 there was a two bushel per acre yield response but there was no response in 1970.

The semi-dwarf wheat crossbred WW15 gave outstanding results in trials at Yanco and Leeton. It outyielded the rust-resistant, high-tillering variety Tingalen by over 40 per cent. In addition WW15 gave excellent responses to both water and nitrogen.

A pot trial provided information on the pattern of water use by wheat throughout the season and the effects of soil moisture level on water use. The technique provides a useful means of comparing treatments, but absolute figures cannot be applied to the field situation.

Wheat Fertilizer Trials

The response of wheat to soil applications of zinc sulphate was tested on a number of trials in the north west during the 1969–70 season. Responses of four to six bushels per acre were obtained in the Liverpool Plains area where significant responses to zinc had previously been obtained with maize and sorghum. In previous trials wheat had failed to respond to foliar applications of zinc.

Variation in response to superphosphate application at three different times of sowing was studied in two trials in the north west. The grain and yield component data obtained will be studied in relation to data from trials in 1968 and 1969.

In the central west, the number of nitrogen x phosphorus trials on wheat was reduced. Greater emphasis was placed on detailed environmental studies. The aim of the studies is to relate the yield responses to nitrogen and phosphorus to other factors such as temperature, humidity, rainfall and soil moisture.

In the 1970–71 trials yield responses to superphosphate were among the highest in the seven years of the project. These very high responses were obtained despite an abnormally dry period between mid-May and mid-August.

Field Wheat Competitions

Seven Divisional Dryland Championships were conducted during 1970 by the Royal Agricultural Society. Most of the local and all of the Championship judging was done by officers of the Department.

The 730 entries judged in 86 local competitions contrasted with 806 crops in 93 local competitions in 1969 and 873 crops in 88 local competitions in 1968. Preliminary judging by farmer judges in some local competitions reduced the entries to a maximum of 10 to be judged by the Department's officer.

The numbers of local competitions and entries in each Division and the championship crops in 1970 were:

Division	No. of local competitions	Local Entries	Championship crop	
			Variety	Est. Yield bushels/acre
Northern	11	107	Gamut	45
Northern Slopes	10	73	Tingalen	66
Western	16	160	Gatcher	44
Central Slopes	15	119	Falcon	54
Central Tablelands	3	28	Olympic	51
Riverina	17	150	Falcon	48
Southern Slopes	14	93	Falcon	49
	86	730		

The Royal Agricultural Society also sponsored irrigated field wheat competitions in 1970. These were conducted by one Agricultural Society each in the Northern and Central Slopes Divisions and two in the Southern Slopes Division. The Department was not associated with judging of the irrigated competitions but advised the R.A.S. on aspects such as judging procedure and scale of points. Details of the competitions were:

Division	No. of Entries	Winning Crop		
		Variety	Locality	Est. Yield bushels/acre
Northern	7	Timgalen	Walgett	50
Central Slopes	9	Pinnacle	Hillston	48
Southern Slopes	15	Pinnacle	Griffith	51

OATS

Acreage and Production

The 1970–71 oat production was estimated at 25,000,000 bushels, well above the 19,238,000 bushels obtained in the previous year but well below the record of 41,003,000 bushels harvested in 1966–67.

The area harvested for grain in 1970–71 was 1,000,000 acres and the average yield was 25.0 bushels per acre. Hay production was estimated at about 114,000 tons from an area of about 69,000 acres. Total sowings for all purposes were estimated at 1,920,000 acres of which 845,000 acres were used solely for green forage.

Popularity of Oat Varieties

The biggest change in popularity of varieties was the upsurge in the acreage of Coolabah, which increased its proportion of the total area from 1.3 to 5.4 per cent and rose from ninth to fifth place in the order of importance.

Cooba, the most popular variety in N.S.W. since 1965, now occupies over 35 per cent of the total area.

The proportion of the area sown to Avon fell significantly although it retained second place among the varieties. Slight decreases in area were recorded for Algerian, Belar, Fulmark and Fulghum while the area of Bundy increased slightly.

Oat Experiments – Variety Trials

During 1970–71 replicated oat variety trials were sown on the properties of 55 farmers (67 in 1969–70) under the supervision of 31 (32) district agronomists – 20 (20) varieties were tested. In addition, oat variety trials were conducted on eight research stations. A number of promising crossbreds and new varieties were tested against standard varieties in these trials.

Oat Variety Recommendations

Fulghum was deleted from recommendations as it is inferior in yield to Cooba when sown early and inferior to Coolabah when sown late. In addition Fulghum was very weak straw and is highly susceptible to loose smut.

Fulmark was withdrawn as it is inferior to Avon and Coolabah for grain production, inferior to Coolabah for grazing, and inferior to Avon, Bundy and Coolabah for grain recovery after moderate grazing.

No new varieties were added to recommendations for the 1971–72 season.

Oat Variety Performances

The two Glen Innes crossbreds P4315 and P4319 performed well in trials throughout the state. They were favoured by good rainfall in late spring which helped later varieties more than early ones such as Cooba and Coolabah. In addition to high yields, P4315 and P4319 have satisfactory tolerance to stem rust, good straw strength and satisfactory resistance to smut.

Oat Improvement in Northern N.S.W.

An oat breeder was appointed to Glen Innes Agricultural Research Station at the beginning of the 1970–71 season. However, because of his lack of field experience only a small breeding programme was carried out. A number of promising crossbreds were sown in a replicated trial and in unreplicated observation plots. Some were rejected because of susceptibility to smut, poor straw strength or mediocre yield.

BARLEY

Acreage and Production

The increased interest of N.S.W. farmers in the growing of barley, particularly the malting types, was underlined by the acreage and production figures for the 1970–71 season.

The acreage sown to barley in the state in 1970 set another record, continuing the trend of the past 20 years. The total acreage jumped from 211,000 acres in 1960 to 432,000 acres in 1966, 640,000 acres in 1969, and an estimated 830,000 acres in 1970.

Production rose from 4.7 million bushels in 1960–61 to 12.3 million bushels in 1969–70 and an estimated 18.9 million bushels in 1970–71.

In 1969–70, the last season for which final statistics are available, 6,788,000 bushels of two row (malting) types and 5,547,000 bushels of six row types were harvested from 542,000 acres sown for grain – average yield of 22.8 bushels per acre.

Further increases in yield per acre are expected to follow the recommendation of the new two row variety Clipper for 1971 sowings. In the Department's trials Clipper has yielded about 25 per cent better than Prior, which has been the standard malting barley variety for many years.

Barley Experiments – Variety Trials

In 1970–71 replicated barley variety trials were arranged with 33 farmers (36 in 1969–70) supervised by 23 (25) district agronomists and testing a total of 12 (11) varieties. In addition trials were conducted at Trangie, Condobolin, Cowra, Leeton and Yanco Research Stations.

Barley Variety Performance

Varieties and crossbreds of comparatively recent origin tested during the season were Dampier, Bussell, Clipper, Ketch, Weah and A16. Bussell, Clipper and Weah differed only slightly in yield and Dampier was somewhat inferior.

The newly released very early variety Ketch was tested in only a small number of trials; it outyielded Noyep conclusively in most. A16 yielded about the same as its sister selection Bussell in preliminary trials.

The best of the two row varieties – Clipper, Bussell and Weah – yielded about the same as the early six row variety Beecher.

Barley Variety Recommendations

The South Australian variety Clipper, released in 1968, was added to variety recommendations in N.S.W. for 1971–72. Trials have shown Clipper to be adaptable over a wide area and about 25 per cent higher yielding than Prior. Prior will be retained in recommendations until Clipper is more widely accepted by millers.

CEREAL RYE

Acreage and Production

Latest available production statistics are for the 1969–70 season when 27,856 acres of rye were sown for all purposes. Grain production was 170,670 bushels from a harvested area of 14,067 acres at an average yield of 12.1 bushels per acre. It is thought that grain production in the 1970–71 season was similar to that of the previous season.

The Department maintained basic seed stocks of the varieties Weethalle and Strain 8 and distributed seed of both to co-operating farmers for seed increase and distribution to other growers.

A number of rye millers and processors have expressed interest in obtaining seed of European varieties which are reputed to be of higher quality than local strains.

CEREAL PURE SEED PRODUCTION

Supplies of pure seed of recommended and promising varieties were increased on eight research stations and distributed to Registered Seed Growers throughout N.S.W.

In 1970–71 Foundation Seed sowings on research stations totalled 165 acres of wheat (125 acres in 1969–70), 103 (73) acres of oats and 34 (37) acres of barley. In addition to and associated with these sowings, initial selection and preliminary seed increase of wheat, oats and barley were conducted at Temora Research Station.

A total of 337 (326 in 1969–70) Registered Seed Growers participated in the Registered Seed scheme in 1970–71 and disposed of large quantities of pure seed to other growers. Altogether 171 (169) Registered Seed Wheat Growers, working under the supervision of 31 (31) district agronomists throughout the wheatbelt and using Foundation Seed supplied by this Department, undertook seed increase of 15 (16) varieties. There were 126 (120) Registered Seed Oat Growers, in 33 (30) district agronomists' areas, increasing seed of 12 (13) oat varieties; and 40 (37) Registered Seed Barley Growers producing pure seed of 10 (7) barley varieties in 21 (22) district agronomists' areas.

MAIZE

Acreage and Production

The area of maize was estimated at about 85,000 acres. Irrigation has stabilised production; production was estimated at about 4,700,000 bushels, a 20 per cent increase on the record production of the 1969–70 season. The area irrigated was 35,000 acres, the same as in the previous season.

Excessively wet conditions reduced yield and grain quality on the coast. However, inland irrigated areas received above-average summer rains and a dry autumn allowed completion of harvesting earlier than in any previous season. Grain quality was high and yields were generally satisfactory. An average yield of 80 bushels per acre was expected from irrigated sowings in southern and central inland districts of the state where some individual growers harvested 120 to 130 bushels per acre from areas of 200 to 300 acres. Leaf blight (*Helminthosporium turcicum*) and mosaic virus were the worst ever experienced in northern inland crops, reducing yield to an average of about 60 bushels.

Early Sowings Successful

The value of early sowing for maize was demonstrated this year. Harvesting of early-sown crops under good temperature conditions enhanced grain quality, reduced drying costs, minimised disease and enabled early commencement of soil preparation for subsequent crops.

New Hybrids

The hybrid XL45 yielded well on inland irrigated soils. Demand for seed of this hybrid exceeded supply for the second season in succession. XL361, DS805A, PQ300 and PQ301 were grown over a larger area and continued to yield satisfactorily.

There was a preference for the short-statured hybrids in irrigated areas. Sowings of these hybrids on the flat in irrigated bays and harvesting with open-front headers were again tested with reasonable success.

The late-maturing hybrid, GH390, released last year from Grafton Agricultural Research Station for coastal use was grown commercially for the first time but on only small areas.

Disease Damage

The wet summer caused greater than normal disease problems. Leaf blight (*Helminthosporium turcicum*) was worse than for many years throughout the coast; yields of susceptible varieties were reduced by 50 per cent in some cases. Leaf blight occurred in some inland districts for the first time. A dry autumn prevented serious development of the disease but reduction of the yield was significant in some crops.

The worst disease of most inland crops was a virus disease identified as a type of maize dwarf mosaic. The general reduction in yield was small but the susceptibility of present hybrids and the importance of developing new disease resistant hybrids was apparent. Late-maturing hybrids, bred from inbreds which had been developed from Australian open-pollinated varieties, showed better resistance to this virus disease than did hybrids based on introduced American inbreds.

Insect Pests

Earworms caused severe damage in some crops. They attacked both tassels and silks, affecting both pollination and grain set and so reducing yield. Late-sown crops were worst affected. Grain weevil was again the most serious pest in coastal maize. It was particularly bad in early crops, as usual.

Plant Populations

The availability of early-maturing, short-statured hybrids resulted in increased plant populations per acre. Between 20,000 and 24,000 plants per acre, in conjunction with irrigation, produced the highest-yielding crops. Some crops that were too dense produced grain of reduced size which resulted in resistance by buyers. But, generally, growers used correct plant population for the available hybrids. There was a demand for better graded seed, which served to underline the limitations of existing equipment for precision sowing.

Tall-growing, late-maturing coastal hybrids were generally sown at 12,000 to 16,000 plants per acre. However, there was a tendency to increase plant densities on some coastal farms and those crops with populations of 18,000 and 20,000 plants per acre gave best yields.

Utilisation and Marketing

Production of grain exceeded local requirements. The Australian Coarse Graingrowers' Association formed a pool for export and more than 7,000 tons was sold to Japanese buyers.

Portion of the grain required by local firms for production of breakfast foods and starch was grown under contract by selected growers. Interest in waxy maize was maintained and crops were grown under contract for one firm; the waxy starch is used as a thickening agent in prepared foods.

Manufacturing and feed demand was for yellow maize, and 99 per cent of the crop was of this type. Enquiries on the production of white maize for export increased, but production did not eventuate.

An estimated 80 per cent of coastal production was used for on-the-farm supplementary winter feeding of dairy herds. Usually whole ears in husk were hammer milled for this purpose.

Nutritional Disorders of Maize and Fertilizer Use

Zinc deficiency was again prevalent on alkaline soils in inland areas. Co-operative studies to determine the most effective treatment to overcome zinc deficiency were continued with the Chemistry Branch. Yields from some crops were considerably improved by foliar spraying. Soil application of zinc sulphate was adopted by some growers in preference to foliar spraying for the first time with very good results.

Molybdenum deficiency was again observed in coastal areas and was associated with the use of seed of low molybdenum level. Routine checking of hybrid seed for its molybdenum content by the Chemistry Branch and remedial measures taken with seed producers reduced deficiency symptoms in commercial crops. Investigations by the Chemistry Branch have shown that foliar application of 4 lb of sodium molybdate per acre in the 2 to 3 feet growth stage of seed crops raises the molybdenum seed level and obviates the need for soil application of the heavy rates of molybdenum currently recommended.

Nitrogen was used at heavier rates by some producers. Anhydrous ammonia was popular, particularly on irrigated areas, and rates in excess of 100 lb per acre were used by some growers. Nitrogen in granulated mixed fertilizer forms was the most common form used on the coast. Crops were side-dressed with additional nitrogen as deficiency symptoms occurred during the wet summer. Determination of the most economic nitrogen rates for use on various soil types proved most difficult.

Superphosphate use on crops was general. Rates varied from ½ to 4 cwt per acre, according to district recommendations. Use of molybdenum superphosphate was confined to certain coastal soils.

Hybrid Maize Improvement Programmes.

A wide selection of early-maturing hybrids developed by commercial organizations were available to growers; they occupied most of the irrigated area planted.

The late-maturing hybrids of the Department, particularly GH128, dominated coastal maize sowings. Experimental, late-maturing hybrids developed by one of the commercial seed firms were tested and showed distinct promise for coastal conditions.

The Department's breeding programmes to develop early and late-maturing inbreds and hybrids were continued at Glen Innes and Grafton Agricultural Research Stations.

At Glen Innes, the season was adverse and progress made with some projects was limited.

Conversion of inbreds to the male sterile and restorer forms continued.

A further generation of back-cross material was obtained in the programme to develop maize hybrids with high lysine grain.

Blended seed from the Australian synthetic variety collection, following the second year production at two centres in N.S.W. and two centres in Queensland, was sown. Seed was obtained for another re-combination planting.

The testing of single cross and double cross hybrids was curtailed by the wet season but 12 new double cross hybrids were synthesised. The recently-proved inbreds PA887P and HD2271, featured in nine of these.

At Grafton, above-average summer rains made improvement work difficult, and the loss of some breeding material resulted.

Work to develop synthetics as sources of new inbred lines was advanced further. Crosses were made of 16 exotic varieties from the International Maize and Wheat Improvement Centre, Mexico, with the locally adapted hybrid GH128. The F1 crosses were then used in a crossing block as female parents with a mixture of the crosses as the pollen parent. Hybrid GH128 out-yielded all F1 crosses except the cross with Tuxpeno. No cross lodged significantly more than GH128 but two, involving the varieties Reventador and Chapalote, lodged significantly less.

A mixture of 12 elite mid-season inbreds in all possible combinations was sown in an isolated random mating block as a second step in the development of a Grafton synthetic.

A composite of all available samples of the open-pollinated variety Fitzroy was sown for the third season and further selections were made towards double-cobbing and stalk strength.

Development of new inbred lines. — Inbred development and maintenance continued; six new inbreds were named and 148 selections were planted for further inbreeding.

The 89 progenies sown to develop modified dwarf lines utilising the "Brachytic-2" gene represented 26 Grafton inbreds.

Amongst 99 inbred lines evaluated for general combining ability, the new lines to show promise were the Grafton lines CF1 and C1, and the introductions Tx332 (ex Texas), G4 (a white Egyptian line) and NC230 (ex North Carolina). The general combining ability of 161 inbreds from the Queensland Department's maize breeding programme was tested in a co-operative project.

In single cross yield tests, inbreds NN14, T204, 13A, 13C, 68, KE31, CI21, CF1, HC and 25 showed most promise. The Tennessee line T206 exhibited high combining ability, but crosses with it were very susceptible to lodging. Inbreds 21, 68, 25, 13A, 13C and KE31 imparted lodging resistance to single crosses.

Further improvement of inbred lines. — The conversion of inbreds to the male sterile and restorer forms was continued. Fourteen elite inbreds were advanced to a further back-cross stage. Male fertility restorer versions of inbreds Y1 and 61A were recovered during the season.

Work to develop resistance to leaf blight (*Helminthosporium turcicum*) continued. Newly acquired inbreds were screened for resistance under artificial epiphytotic conditions. Wet seasonal conditions helped the general observation of blight reactions.

A back-cross programme, to introduce the "Ht" gene for blight resistance into a number of elite inbred lines, was initiated. The blight reactions of eight inbred lines and 18 hybrids were determined.

In blight reaction tests, 14 inbred genotypes, each in normal and Texas male sterile cytoplasm (T) were screened. No significant differences in reactions were observed between the different cytoplasm except in the case of inbred Y1, in which plants with T cytoplasm were rated moderately resistant, while those with normal cytoplasm were rated moderately susceptible.

F2 progenies of crosses between four Grafton blight-resistant source-lines and 16 early-maturing lines were sown for further selection towards early maturity and blight resistance.

Hybrid Maize Yield Trials

There were 22 trials with early, mid-season and late-maturing hybrids throughout the state. XL45, XL361, QP300, QP301, DS805A, DS606A, NEH1151, NES1002 and NEH1215Wx, which occupied most of the commercial area, continued to perform well in trials of early-maturing hybrids.

The late-maturing hybrid GH128 continued to perform satisfactorily under coastal conditions but the new hybrid GH390 proved equal in yield and better in stalk strength.

Hybrid Maize Seed Certification

The following table gives comparative information on hybrid maize seed certified in 1970-71:

Hybrids	Growers	Acres	Sealed 50 lb Sacks
Early	7	89	735*
Mid-Season	5	16.50	897
Late	29	430.25	16,961
<i>Totals 1970-71</i>	41	535.75	18,593
<i>Totals 1969-70</i>	43	614	19,004
<i>Totals 1968-69</i>	49	626	19,960

*Yields reduced by floods

GH128 accounted for 90 per cent of the seed certified. Commercial organizations' seed was not certified but produced and sold under each company's guarantee.

SWEET CORN

Acreage and Production

Approximately 3,500 acres of sweet corn were grown under contract for canning and approximately 200 acres for quick freezing and fresh market sale. Although yields of seven to eight tons per acre were obtained from isolated crops, average yields were below normal as a result of the cool wet season. Early-sown crops yielded better than late plantings.

Leaf blight and rust were the heaviest ever experienced in the Windsor-Richmond district. Growers decided that it was uneconomic to harvest some areas because of severe leaf blight. All hybrids proved susceptible to the disease, with NK199 perhaps slightly less susceptible than others. Hybrids Iochief, NK199 and NK195 occupied most of the area sown. A new variety, Code 22, grown for the first time, yielded consistently well at Tumut.

Quick-frozen husked and trimmed ears in clear polythene packs continued to be supplied to a small but increasing market.

Sweet Corn Improvement

Inbred lines I5125 and I453 were maintained at Glen Innes Agricultural Research Station and made available for seed production of the hybrid Iochief. The male sterile line I5125 and the restorer version of I453, developed at Glen Innes, were supplied to a commercial firm for use in seed production.

Experimental and commercial hybrids were tested at Hawkesbury Agricultural College for yield and quality; NK199 showed its superiority in both respects.

POPCORN

There were 650-700 acres of popcorn under contract for processing. The estimated yield was 530 tons. Production was largely confined to Mudgee (400 acres) and Glen Innes (250 acres). Yields as high as 80 bushels per acre were obtained from the best irrigated crops.

Development of male sterile and fertility restorer inbred lines was continued at Glen Innes Agricultural Research Station.

GRAIN SORGHUM

Acreage and Production

Record acreage. — Large areas not sown to wheat because of adverse conditions in 1970 were used for grain sorghum and a record area estimated at 450,000 acres resulted. This was an 80 per cent increase on the record acreage of the previous season. Irrigated crops were estimated at 62,000 acres, or about 14 per cent of the total area. Approximately 93 per cent of the dryland sorghum acreage was grown in the north west of the state.

Yields. — Most growing areas recorded the wettest summer on record. Although some crops were lost by flooding, dryland sowings were favoured by ample soil moisture and record yields resulted. Yields of between two to three tons per acre were common from dryland crops in the north, while isolated irrigated areas yielded as high as four tons per acre.

In the central west, where low summer rainfall normally prevents safe summer crop growth, some dryland crops produced yields of from half to one ton of grain per acre.

Ideal harvesting conditions in all districts resulted in the production of good quality grain of high bushel weight. The good harvesting conditions also reduced the need to artificially dry grain from early-maturing crops but grain drying became necessary after the end of March.

Production. — Production estimated at 18,000,000 bushels or about 482,000 tons was about 3 times the record yield of the previous season.

Testing of hybrids. — Commercial seed firms again produced a wide range of hybrids and the testing of new lines continued. Seed was produced in N.S.W. and Queensland by three large companies and supplemented by seed of hybrids developed and certified by the Department of Primary Industries, Queensland; 19 hybrids of various maturities were available for commercial sowing with those of early to mid-season maturity in greatest demand.

Pests and diseases. — Early sowings escaped damage by sorghum midge but some late crops were affected.

A mosaic virus disease caused stunting and discolouration of commercial crops early in the season, but its effects were less noticeable as the season advanced. Valuable information on the degree of susceptibility of commercial hybrids to the virus disease was obtained.

Damage to some irrigated crops resulted from the pre-emergence use of atrazine for weed control where heavy rain followed application.

Export of Grain

The Australian Coarse Graingrowers' Association was again active in the export of grain sorghum, principally to Japan. The Grain Elevators Board and transport authorities provided excellent co-operation in handling the grain for export.

To the end of June, 1971, over 300,000 tons were delivered by growers to export pools. Exports from the Port of Newcastle included one large shipment of 36,000 tons. Some grain from the southern parts of the state was exported from Victorian ports. Only one N.S.W. export grade applied and only a small percentage of grain failed to meet specifications. The price from export pools was expected to be approximately \$30 per ton at the production point — a little better than in the previous season.

Grain Sorghum Trials

Trials to evaluate the large range of available hybrids were continued. There were 23 trials with early, mid-season and late maturing hybrids. Tx610, Tx626, Tx671, NK220Y, NK207, NK133, NK212, NK275, Pacific 303, Pacific 007, Pioneer 846, De Kalb E57, E55E and F65, were prominent in state-wide trials.

Mid-season to late hybrids produced the best yields under irrigation but early-maturing hybrids were in demand because of their greater likelihood of producing a crop under dryland conditions. Seed of some of the earlier-maturing hybrids was insufficient to meet demand.

Trials with Irrigated Sorghum

Variety, population and sowing time interactions of irrigated sorghums were tested in trials at Narrabri and Leeton Agricultural Research Stations. The hybrids Tx610, NK220Y, Pacific 007 and Pioneer 846 were sown at three-weekly intervals, commencing on October 12 at Narrabri and on November 21 at Leeton, using 90,000, 120,000 and 150,000 plants per acre. Both trials were irrigated.

At Narrabri, flooding prevented harvest of the first sowing but all hybrids gave their highest yields from the last sowing date, November 20. There was a significant yield increase from Tx610, NK220Y and Pacific 007 when populations were increased from 90,000 to 120,000 plants per acre at the two sowing dates, but the yield from Pioneer 846 was depressed by this population increase at both sowings. Yields of all hybrids appeared to be depressed with populations exceeding 120,000 plants per acre, confirming results obtained last year. Results from the Leeton trial were not available when this report was prepared.

Fertilizer Use

Less nitrogen was used on irrigated sorghum than on maize. Nitrogen as anhydrous ammonia was most popular. On dryland sorghum little nitrogen was used, but the use of superphosphate at rates similar to those used with wheat was general.

FORAGE SORGHUMS

Good summer rains caused growth of many crops to exceed requirements and led to more interest in conservation as silage. Sudan grass-sweet sorghum hybrids occupied most of the area sown. There were limited areas of the open-pollinated Piper sudan and sweet sorghum varieties.

Commercial organizations continued the development of new hybrids.

Twelve commercially available hybrids were tested at Tamworth Agricultural Research Station under dryland conditions. There was no significant difference in yield between four top yielders — Zulu, Bonanza, Sx11A and Sx6. However, these hybrids significantly out-yielded all others in total dry matter production over the season. The sweet sorghum hybrids FS1A and FS26, and the sudan grass hybrid Trudan, yielded poorly at Tamworth.

MILLETS

Broom Millet

The area sown to broom millet was estimated at 1,500 acres. Continued wet conditions resulted in a poor harvest in the Lismore and Maitland districts, but the season was good at Tumut.

Only a third of 400 acres sown in the Lismore district was harvested for a yield of approximately 50 tons. Sowings at Maitland were reduced and flooding damaged most crops. An area of about 1,000 acres sown at Tumut gave an average yield of about seven cwt per acre.

State production was expected to be approximately 450 tons, about 100 tons lower than the previous season. Some carryover stocks on farms were available to supplement 1970–71 production.

Improvement. — Work to improve quality through selection within the White Italian variety continued at Glen Innes Agricultural Research Station but seasonal conditions made progress difficult.

Fodder and Grain Millets

Millets were sown in most districts for summer and autumn forage. The main varieties were Japanese and Siberian.

Pearl millet, particularly the departmental variety, Tamworth, was used more extensively for grazing as seed supplies became more readily available. The first hybrid pearl millet released in N.S.W. Mx001 was marketed by a commercial firm. Trials indicated that the hybrid is not superior in dry matter yield to available open-pollinated pearl millet varieties but that it is superior in standing ability and grain production.

Summer growing conditions were good for grain millet production. Crops of the variety Japanese not required for grazing were harvested for grain and the surplus created marketing difficulties.

Grain production from Setaria and White French millet for the birdseed trade was mostly confined to the north west of the state, where approximately 1,500 acres were harvested. Production was estimated at 350 tons of which 80 per cent was Setaria.

CANARY SEED (*Phalaris canariensis*)

It was estimated that about 3,700 acres were sown to canary seed in 1970–71. This was less than the 4,566 acres recorded the previous year.

The bulk of the N.S.W. crop was grown in the Inverell and Moree districts but small areas were sown at Cowra, Dubbo and Finley. Yields were reasonably satisfactory.

Broadleaf weeds, particularly those of Brassica species, caused some production problems.

RICE

Acreage and Production

The area sown to rice in 1970–71 was 95,315 acres, 1,035 acres less than in the previous season. The average yield of 2.98 tons per acre at 14 per cent moisture and the harvest of 283,884 tons were both records. Production of the long grained variety Kulu more than doubled to 73,154 tons. This was due in part to an incentive payment of an additional \$12.50 per ton for Kulu and also to a high average yield. The production of Caloro was also substantially higher but that of Calrose fell.

After a poor start due to cool weather in October, rice in all districts grew well. About 75 per cent of the crop in the Murray Valley was aerially sown. The absence of both heatwave conditions and cool nights at flowering favoured the attainment of a high average yield. Continuing favourable weather after flowering promoted rapid grain development and maturation. Harvesting conditions were ideal although in some instances grain had to be harvested at an undesirably low moisture content.

The whole grain millouts, shown in the table below, demonstrated a considerable improvement in Kulu quality compared with the previous year. The percentages for 1970 are actual and those for 1971 are estimated from Rice Marketing Board Appraisal Laboratory figures.

Variety	1970		1971	
	Production	Whole Grain Millout %	Production	Whole Grain Millout %
Calrose	188,760	66	178,130	60
Kulu	35,593	28	73,154	51.8
Caloro	15,072	60	32,383	55

The Rice Sterility Problem

The rice sterility condition known as "Straighthead" was observed widely in 1970–71. It was noted on various soil types and in differing environments. The cause may not be the same in all cases. Following plant analysis a number of possible causes have been considered and arrangements are being made for research into the problem on some of the affected sites.

Rice Breeding and Improvement

The breeding programmes at Yanco Agricultural College and Research Station were maintained during the year by the second rice breeder. The senior rice breeder returned late in the season after completing Ph.D. studies in the U.S.A.

The breeding programmes greatest emphases are upon the production of a high quality long grained rice, early maturity, lodging resistance and continuing high yields per acre.

The three sections of the plant breeding programme were sown at Yanco Agricultural College and Research Station and the CSIRO Field Station at Deniliquin in October and at Yanco Agricultural College and Research Station in mid November. At these sites some 40 bulk populations and approximately 7,000 panicle rows were sown. Although several long, medium and short grained lines yielded as well as the commercial check varieties none outyielded them. At Yanco, 72 crosses were made.

The advanced lines: YR6–54–10–5, YR6–54–10–7, YR13–89–9, YR13–89–11, (all long grained); YR6–100–9, (medium long grained); and YR140 (glutinous grained) were increased on district properties on areas of about two acres each. These lines were also tested in seven large plot replicated trials in both northern and southern rice growing regions. YR6–100–9 yielded very well and also has the advantage of good straw strength and early maturity. The remainder, although not superior in yield, exhibit other valuable characteristics.

Rice Agronomy Research

Research was continued into timing, rate and placement of nitrogen fertilizer, the use of nitrogen inhibitors, rates of nitrogen for aerial sowing, nitrogen requirements of rice varieties at different plant densities, sowing rates, the effect of establishment method on nitrogen requirement and crop development and growth, together with the role of climate.

Investigations into the benefits of pre-harvest desiccation as an aid to harvesting continued. The desiccant treatment increased yields and speeded harvesting in the heavy plots, but problems exist in respect of grain quality and spray penetration into lodged crops. It is in such crops that desiccation would probably be most valuable.

As results of research become available they are quickly transmitted to the growers through the Irrigation Research and Extension Committee (I.R.E.C.) and the local extension programmes.

Rice Soil Nitrogen Investigations

Considerable preliminary laboratory, pot and field work was undertaken towards identifying the characteristics and amounts of nitrogen apparently lost during the flushing irrigation period in combine-sown rice crops.

The investigations indicated that some soil types rapidly nitrified ammonia except where the soil pH was unfavourable and that the per acre loss of nitrogen in a single day during the flushing period could be as high as 35 lb. The rate of nitrogen loss increased at higher fertilizer rates and was accelerated by the addition of lime. However, nitrification could be retarded effectively by the presence of sufficiently high concentrations of chemical inhibitors such as "n-serve" or D.D.A. (dicyandiamide). These preliminary results will require verification.

Co-operation with the Rice Industry

Liaison continued between the Department and representative bodies from the rice industry. The I.R.E.C's Rice Investigation and Rice Soil Testing Sub-Committees continued to review progress and suggest research and extension programmes.

In 1970 the Rice Industry contributed \$15,000 to a special research fund which was matched dollar for dollar from the Commonwealth Extension Services Grant to provide a total of \$30,000 for rice research facilities. Part of the money was spent and at the end of the report year a glasshouse for rice breeding was almost complete. The greater part of the funds were still available for the provision of facilities for physiological research.

There were large attendances of growers at the field days at Yanco Agricultural College and Research Station, on the Coleambally Irrigation Area and in the Deniliquin district to demonstrate and disseminate the technical advances being made by the rice research team.

Rice Parboiling Plant

During the 1970-71 season the Rice Growers' Co-operative Mills Ltd commenced the construction of a parboiling plant at Leeton. The plant will use about 10,000 tons of paddy annually, probably long grained, and will produce an additional market type of rice. The advantages attributed to parboiled rice are improved whole grain millouts, improved storage characteristics, cooking and canning stability and higher nutritional value.

MISCELLANEOUS CROPS

PULSE CROPS

Cowpeas

Cowpeas retained their popularity for summer forage on the coast. Poona and Caloona were the only varieties grown. Caloona has been considered the more disease resistant but there were indications that its resistance to stem and root rots had broken down under the wet summer conditions which were conducive to disease.

An area of about 25,000 acres, mainly in the north west, was sown for cowpea grain production. Yields were 10 to 15 bushels per acre.

Some grain was exported and reportedly was mainly for use as a filler in processed meat products. Prices of \$2 to \$3 per bushel were a little above average.

Seeding rate trials at Tamworth Agricultural Research Station indicated that 15 to 20 lb per acre are required for grain production.

Mung Beans

Yields as high as 15 bushels per acre were obtained from 200 acres of the variety Celera, grown under contract to a grain merchant in the Inverell district. Celera was released by the Department.

Some grain was exported; its main use was to supply sprouts for continental cooking.

Investigations at Tamworth Agricultural Research Station indicated: that a seeding rate of 15 to 20 lb per acre gave highest yields; that Celera does not shatter; and that under normal summer conditions Celera requires about 90 days to reach maturity.

Two varieties with superior sprouting qualities, Small Red and Black Mappe, introduced from Japan by a private company, were grown under quarantine at Grafton Agricultural Research Station. Approximately 100 lb of seed of each variety were harvested for further research and seed increase.

The variety Berken was seed increased to a limited extent.

Sweet Lupins

Approximately 3,000 acres of the variety Uniwhite were grown. Yields varied from 6 to 35 bushels per acre and grain protein ranged between 30 and 38 per cent.

Observations showed that Uniwhite shattered 15 to 20 per cent of its grain when harvesting was delayed. The crop is also very sensitive to weed competition in the early growth stages, and early sowing — from mid-April to mid-May — is desirable. The herbicide trifluralin successfully controlled ryegrass in some crops.

Experimental sowings of an improved variety, Uniharvest, were made at Yanco and Narrabri Agricultural Research Stations. Uniharvest proved completely non-shattering and had maturity and yield similar to Uniwhite. Yields of grain in excess of one ton per acre were obtained at both centres from the two varieties under furrow irrigation.

Seed sales of Uniwhite were sufficient to sow about 50,000 acres in 1971. Experimental areas were planned for all parts of the state.

Research into sowing time and seeding rate was initiated at Temora, Cowra, Tamworth, Wagga and Glen Innes Agricultural Research Stations, herbicide research was conducted at Wagga Agricultural Research Institute and grain feeding trials with poultry and pigs were commenced.

Field Peas

About 3,000 acres planted to field peas in the southern part of the state was the largest area in N.S.W. for 30 years. The variety Dun was most popular but there was a small area of Derrimut. Good growing conditions resulted in yields of up to 40 bushels per acre.

A limited tonnage of grain was exported to Japan. The Victorian split pea trade absorbed the bulk of the remainder.

Research into varieties, seeding rates and sowing times was initiated at Wagga, Temora, Cowra, Tamworth and Glen Innes Agricultural Research Stations. Experimental areas to assess the crop's value as an alternative to wheat were planned for most districts of the state.

LEGUMINOUS FORAGE CROPS

Vetches

The popularity of grazing oats, and disease susceptibility of available varieties, caused a further decline in the use of vetches as a winter-spring forage on the north coast. Approximately 7,000 acres were planted, nearly all with the variety Golden Tares.

The recently released woolly pod vetch variety, Namoi, was seed increased in inland areas. It shows potential for marginal subterranean clover districts and compares favourably with medics in growth and regeneration.

Investigations at Wollongbar Agricultural Research Station revealed a selection, *Vicia sativa* (s.sp. *augustifolia*), P.9243, with resistance to rust and post-emergence damping-off diseases. Seed of this selection is being increased preparatory to further research.

Lab Lab Bean

Approximately 12,000 acres of this legume were sown on the north coast for late summer and autumn forage. Lab lab has increased its popularity because of its ability to provide high protein feed as pastures decline in the autumn.

COTTON

Production

From a sowing of 65,240 acres, N.S.W. production was estimated at 58,000 bales. This was the second successive poor crop. It compared badly with the 1969–70 production of 92,550 bales. Flooding, especially severe in the Namoi Valley, destroyed or reduced the yield of many crops.

In comparison with 1969–70, the area sown increased in the Namoi Valley, remained fairly constant in the Macquarie Valley and decreased at Bourke and in the southern districts. No cotton was ginned in the south.

The Namoi Valley. — About 52,000 acres of cotton were sown in the Namoi Valley, where production was estimated at about 47,000 bales.

Early sowing conditions were satisfactory, but cool weather subsequently retarded establishment. Favourable growing conditions in December and January were followed by severe flooding in February. The major portion (possibly three-quarters) of the crop was under water for varying periods. Because of the duration and depth of flooding, recovery was expected to be poor. However warm dry weather in March and April allowed excellent recovery and resulted in good quality cotton. Grades were predominantly middling to strict middling. A feature of the recovery was the ability of the plant to redevelop above the flood level. Thus, although the flooded portion of individual plants failed to be productive, new vegetative and reproductive growth occurred above high water mark which, favoured by seasonal conditions, made a useful contribution to total production.

The Macquarie Valley and Bourke. — Rainfall during sowing disrupted the planting of much of the Macquarie Valley cotton area. An estimated 10,033 acres were sown, some 14 per cent less than intended. The average yield was estimated at about 1.2 bales per acre and the quality was the best that has yet been obtained in that part of the state. Most of the crop graded out as middling to strict middling.

Following sowing, cool weather combined with heavy rain caused numerous problems with soil crusting and emergence difficulties which tested growers' management abilities to the full. Flooding during February was much less severe than in the Namoi Valley but nevertheless reduced production by an estimated 20 per cent. Weather conditions favoured the development of the disease *Rhizoctonia* in the spring and angular leaf spot during the summer.

Approximately 500 acres of cotton were sown at Bourke, a reduction of almost 50 per cent on the area sown in 1969–70. Yields and quality were good in spite of disruptions to irrigation caused by flooding.

Cotton Bounty

The 1970–71 Australian cotton crop was eligible for a total bounty of \$2 million in this final bounty year. The crop gave every indication of being less than 90,000 bales as the result of adverse weather and flooding in N.S.W. and Queensland. Because of this, the average bounty rate was expected to be higher per pound of lint than in some recent years.

Cotton Varieties

Deltapine Smoothleaf continued to be the most widely-sown variety. About 4,500 acres of the longer-stapled, stronger-fibred Hopicala were grown, mainly in the Namoi Valley. Production of Stoneville 7-02 continued to fall. This variety was more popular in the Macquarie Valley than in the Namoi Valley. There were 400 acres of Deltapine 16 sown for seed. This variety should come into commercial production in 1971–72.

Narrow Row Cotton

About 3,000 acres were sown to narrow row cotton in the Macquarie Valley, and 300 acres in the Namoi Valley. Difficulties were experienced in obtaining satisfactory stands. Where stands were thin, added difficulties occurred in harvesting with the new experimental narrow row harvesters, one developed by CSIRO and a second by a partnership of two commercial firms.

Cotton Plant Breeding and Improvement

Breeding and testing of cotton varieties continued. In the Stage I variety trials, which aim to screen new lines and introductions, 26 lines were compared with 4 commercial varieties. Flooding in February reduced yields by about 50 per cent. In the Stage II and III variety trials, 12 and 10 varieties respectively were tested on 4 sites, 3 in the Namoi Valley and the other in the Macquarie Valley. The last named site was abandoned following a poor germination and later flooding.

Breeding objectives include the incorporation of *Verticillium* wilt tolerance or resistance into new varieties having improved fibre length, quality and yield.

In the programme, crosses are made and progenies selected on the basis of their field resistance to *Verticillium* wilt. Three promising lines have been selected from this programme. Due to flood losses the 300 progeny rows sown in 1970-71 must now be resown in 1971-72.

Other Cotton Research

Apart from investigations directly related to varietal improvement, research continued into physiological and nutritional relationships to production. Physiological investigations were conducted into the effects of population and leaf shape differences.

The officer responsible for cotton nutrition research in northern N.S.W. continued his overseas studies towards a Ph.D. degree. In his absence, his previously planned programme of nutrient situation surveys was continued by other staff. In spite of disruption by floods, results already indicate that phosphate investigations are of low priority in the Namoi Valley.

Cessation of Cotton Research in the South West

At the conclusion of the 1969-70 season it was decided to cease cotton research in the south west and to apply the resources to oilseeds research. This decision was made because of:

- the small area of cotton sown in the south west (only 57 acres in 1969-70);
- the wide range of investigations required to firmly establish a cotton growing industry in the face of the comparative advantages of other areas;
- the adequacy of raw cotton supplies from other Australian sources; and
- the opportunities for the production of irrigated oilseeds in the south west.

Co-operative Research

Discussions commenced with CSIRO to examine the benefits of, and possible ways of instituting, co-operative cotton research programmes in N.S.W.

The Fibre Research Laboratory

Laboratory premises and facilities again limited the number of staff of the Fibre Research Laboratory and the volume of work which could be undertaken. Continuing delays have occurred in the import and installation of specialised equipment for the laboratory. When installed this equipment will allow some expansion of activity though the premises will still be temporary. This position is unlikely to be resolved until the end of 1971.

The Senior Research Officer who is in charge of the laboratory commenced studies in a research project aimed at a Ph.D. degree.

A very limited volume of cotton fibre testing, complementary to the field research programme, has again been possible because of the continued co-operation of the University of N.S.W. This Department is extremely grateful for the long-term assistance given by the University.

LINSEED

Acreage and Production

The linseed area in 1970-71, estimated at 50,750 acres, varied very little from the 50,370 acres sown in the preceding season. About 7,500 acres were irrigated. Production was estimated at 16,910 tons and the average yield was high at 13 bushels or 0.336 tons per acre.

In recent years the centre of linseed production has swung away from the north west. In 1970–71, dry conditions in the north at sowing time encouraged contracting companies to move to central and southern districts including the tablelands. About 11,500 acres were sown to linseed in the North Western Agricultural Region and almost 20,000 acres in the Mid Western Agricultural Region. Over 5,000 acres were sown on the southern tablelands in late winter-early spring.

Following the previous favourable season the demand for linseed contracts was high. Contracts were offered by two processors at \$125 per ton, Sydney. The demand for these was so great that previous growers were treated preferentially and many potential new growers were unable to enter the industry.

Industrially, linseed oil faces a falling demand and the world has an oversupply. The relatively high average yields in 1970–71 resulted in the processors having a greater carryover than was previously anticipated. As a result, the 1971–72 contract price for linseed has fallen to \$110 per ton.

Seed Increase and Research

Sowings for seed increase of 12 promising varieties were made at Leeton Agricultural Research Station and a further three were sown at Narrabri Agricultural Research Station. Unfortunately the Narrabri plots were destroyed by floods.

Two new varieties “Glenelg” and “Gibson” were introduced into N.S.W. from Victoria and Western Australia respectively.

District Agronomists conducted trials to investigate linseed sowing and fertilizer rates.

OILSEED RAPE

Expanded Production

In 1970 a substantial area of oilseed rape was sown in N.S.W. for the first time. The area has been estimated at 58,000 acres, which produced about 20,000 tons of seed valued at \$1.8 million.

Rape was sown during late autumn-early winter in the wheat belt and in late winter and spring on the tablelands. The average yield, estimated at 0.35 ton per acre, reflected the favourable spring and summer conditions. This yield was most satisfactory as almost all rapeseed growers were unfamiliar with the crop.

Established crops showed considerable ability to compete with weeds, and those sown early also recovered well from the dry winter period. In some districts large numbers of aphid infested crops during the spring and metasystox was widely used for control. This chemical gave satisfactory control but created problems because of toxic effects on bees in some circumstances.

Considerable expansion of the rapeseed area was planned in the wheat belt for 1971 but because of dry conditions did not occur. However, subject to a satisfactory season, expansion will continue in tableland areas.

The most widely sown variety was Target. This variety and the less important Arlo were both introduced from Canada. The number of varieties in research programmes has been increased and the low erucic acid type, Oro, also introduced from Canada has been included.

Other current investigations concern seeding rates, sowing times, sowing methods under irrigation and fertilizer needs.

Almost the whole of the N.S.W. crop was processed for the home market at a contract price of \$88 per ton, Sydney. Farmers' interest has remained high in 1971 and contracts, at a lower price than for the domestic market, were available prior to the 1971–72 sowing season.

SAFFLOWER

Production

A record 49,000 acres of safflower were estimated to have been sown in N.S.W. in 1970–71, producing an average yield of 0.17 tons per acre. The area was much greater than the 16,022 acres sown in 1969–70. Favourable yields in that year, the continued operation of wheat quotas, and satisfactory soil moisture reserves in 1970, encouraged the expansion of acreage.

The absence of mid-winter rains delayed sowings until August. The major portion of the crop was sown in the central western plains and the northern part of the Riverina.

The weather in early summer remained favourable for crop development but rain in January caused some ripe seed to sprout in the head. Good yields were obtained on well drained soils but many crops gave poor returns. *Phytophthora* root rot was again widespread. Weeds, particularly skeleton weed, slowed growth and caused harvesting difficulties. Harvest was complete by the end of February.

At the contract price of \$95 per ton, Sydney, and the average yield of 0.17 tons per acre, the gross return of \$16 per acre was inferior to that from sunflower at 0.3 tons per acre or rapeseed at 0.35 tons per acre.

Research

Only limited research is carried out on safflower because other oilseeds appear to have a more promising future. A trial of five varieties at Narrabri Agricultural Research Station was destroyed by floods. District agronomists investigated seeding rates and row spacing and safflower was compared with other crops as alternatives to wheat in demonstrations.

SUNFLOWER

Production "Explosion"

Sunflower became the most important oilseed crop in area, production and value in N.S.W. in 1970–71. The area sown was estimated at 212,000 acres. Although about 15,000 acres were lost as the result of floods, production was estimated at about 65,000 tons. The average yield over the whole sown area was estimated to have been 0.3 tons per acre. This is considered satisfactory in view of the growers' lack of experience and losses caused by floods.

Almost three-quarters of the 37,000 acres of irrigated sunflower in inland N.S.W. was in the North Western Agricultural Region, which also had the largest dryland acreage. The greatest concentration was in the Moree district.

Much of the increased area is explained by the late winter rains in the north west and farmers' decisions to grow sunflowers rather than risk a very late wheat sowing.



The area of sunflowers grown in N.S.W. increased from 4,400 acres in 1968–69 to 22,730 acres in 1969–70 and about 212,000 acres in 1970–71. The value of the 1970–71 crop was estimated as \$6,500,000. Low wool prices and wheat quotas have stimulated expansion of acreages of sunflowers and other oilseed crops.

Sunflower sowings commenced in late August. Early sown crops benefited from a favourable spring and early summer. Some crops in the north west were damaged by floods in early February but the heavy rains were generally more beneficial than harmful to dryland crops. Dryland crops sown in the north west after the floods received almost no further rain and hence yields were lower. Some late-sown tableland crops were barely mature when the first frosts occurred. The best dryland and irrigated crops produced about one ton per acre. However, the productivity of many irrigated crops was restricted by poor weed control, poor irrigation layout and/or inadequate water.

Large numbers of Rutherglen bugs were found in most ripening sunflower crops and were difficult to control.

Quality was generally satisfactory. Some growers received a bonus for high oil content. Yield and quality of flooded crops were often adversely affected.

The sunflowers grown in N.S.W. are high-oil varieties directly introduced from eastern Europe and Russia or selected strains of these varieties. As with other oilseeds, sunflower was grown under contract for the domestic market. The price was \$96 per ton, Sydney. New contracting companies entered the field during 1970-71.

Sunflower was crushed at two Sydney crushers and at Narrabri and Moree. The shortage of sunflower seed on the overseas market, coupled with a continuing increase in world demand for vegetable oils, resulted in prices for export sunflower seed being higher than domestic prices. Export shipments of seed and, in one case, oil were arranged by crushers, exporters and a grower organization.

Seed Production

Seed of nine sunflower varieties was increased on research stations. Some were recently-introduced Russian varieties, of which substantial increases were obtained. Samples of 15 lines were supplied to the Queensland Department of Primary Industries' sunflower breeder at Hermitage Research Station.

Sunflower Research

A research agronomist was appointed in 1970 to undertake oilseeds research at Leeton Agricultural Research Station. An important part of this officer's work is with sunflowers.

Sunflower variety testing was undertaken at Narrabri, Leeton and Yanco Agricultural Research Stations. Varieties were also examined at research stations for fertilizer, population, and sowing time responses. Yields in some situations were very good, exceeding 2,500 lb per acre, but lodging due to stem rot, bird damage and hail impaired the results obtained in some trials. At Narrabri Agricultural Research Station all sunflower work was destroyed by floods.

Variety trials examining nine varieties were conducted by eight district agronomists in 1970-71. Fertilizer and seeding rate trials were also carried out in a number of districts.

SOYBEAN

Production

The official statistics for 1969-70 show that 4,713 acres of soybeans (almost entirely irrigated) were grown in N.S.W. This figure is approximately half the Department's estimate of 9,000 acres sown. The estimate was based on a survey. In 1969-70, 20-25 per cent of the sown area failed to establish and a further large percentage was either destroyed or very seriously damaged by a mice plague.

In 1970-71, it was estimated that 6,330 acres of soybeans were sown. This estimate was also derived from survey information. Whilst the difficulties experienced in the preceding year did not recur, flood damage caused failures in various districts. The precise losses caused by floods are not known but it is believed that the area harvested was reduced to 5,000 acres.

The reduced area sown in 1970-71 can be attributed to the poor results of a number of growers in the preceding season and a reduction in the contract price from \$100 per ton to \$95 per ton, Sydney.

Crops that were not affected by flooding generally produced good yields. They were aided by adequate irrigation and an extended, but not hot, growing period. Yields of one ton per acre and more were reported from some areas. The highest reported were 1.3 tons and 1.5 tons per acre.

Successful dryland trial sowings were made on the eastern fringe of the New England tableland.

Diseases were not a problem but there were reports of various insect pests, often in large numbers. There were indications that one or more of four types of bugs observed in crops in south western irrigation districts caused seed injury although yields may not have been significantly affected. Lucerne seed web moth and bean blue butterfly were also held responsible for injury.

Soybean Research

A co-operative programme to evaluate a range of varieties in a number of environments was again conducted in co-operation with the Universities of Queensland and Sydney, and the Victorian Department of Agriculture. This division conducted five of the eight trials in the series established from southern Queensland to northern Victoria. The five trials were at Narrabri and Leeton Agricultural Research Stations and with co-operating farmers in the Gwydir, Namoi and Macquarie valleys. In spite of disruptions by adverse weather and flooding, sufficient information was obtained to permit a revised more advanced programme in 1971-72.

A further co-operative regional adaptation trial in co-operation with Dr D. Byth of Queensland University was carried out at Narrabri Agricultural Research Station. The trial was part of a programme covering Queensland, N.S.W. and northern Victoria. The programme involved 60 soybean varieties each sown on three dates. Unfortunately the trial at Narrabri was destroyed by floods.

A variety x row spacing trial and seed improvement and production areas were destroyed by floods at Narrabri Agricultural Research Station. However, reserve seed of all valuable material was retained in the controlled environment storage room. Research into the effect of row spacing and sowing time on different varieties was conducted at Leeton Agricultural Research Station. Varieties were tested at Yanco Agricultural College and Research Station and an officer of the Entomology Branch co-operated on investigations of insect problems. Research into the effect of time and depth of sowing on the emergence of soybean varieties at Tamworth Agricultural Research Station showed that genotype influences soybean emergence.

Soybean varieties were tested by 13 district agronomists, demonstrating the interest aroused by this crop. Results from these trials confirmed the value of the varieties Bragg and Lee in the northern inland of the state, of Lee and Hill in the central districts, and of Hill, Bethel, Delmar and Wayne, and to a much lesser degree Lee, in the south western irrigation areas. Tests suggested that the varieties suited to the Murray Valley may also be suited to the eastern parts of the northern tablelands. Apart from variety testing, three trials were conducted to examine variety x time of sowing under district conditions in the widely separated districts of Fihley, Cowra and Glen Innes.

As reported earlier, a research agronomist was appointed to undertake oilseeds research at Leeton Agricultural Research Station. Apart from research into sunflowers, this officer has a major responsibility to examine soybean production in the south west of the state. The soybean plant breeding position at Narrabri Agricultural Research Station became vacant prior to sowing and had not been filled at the end of the financial year.

Seed Production

Soybean seed production was undertaken at Narrabri Agricultural Research Station and, to a lesser extent, at the Leeton Station. At Narrabri areas were severely flooded, seriously reducing seed production. Even where seed was produced the quality was inferior.

Seed of the varieties Lee, Bragg, Hill and Wayne was supplied to 18 selected growers strategically located throughout the inland irrigation districts in 1970. The objective was to develop commercial seed sources in different districts. In addition, small quantities of 18 varieties were distributed to a farm consultant who had previously co-operated in the introduction of soybean seed.

TOBACCO

Production

The final survey conducted by the N.S.W. Tobacco Leaf Marketing Board recorded 3,042 acres of tobacco planted on 131 farms in the 1970-71 season. This was an increase of about 11 per cent on the area planted in 1969-70. Production of quota leaf was estimated by the N.S.W. Tobacco Leaf Marketing Board at 2,764,320 lb; an average yield of 909 lb per planted acre. In 1969-70 the average yield was 1,118 lb per acre.

Unfavourable weather, mainly excessive rainfall after transplanting, caused the failure of some areas this year. N.S.W. did not achieve its marketing quota of 3,148,000 lb which was an increase of 70,000 lb on the previous year's allocation. The 182 acres sown in southern N.S.W. resulted in some over-quota production from that part of the state.

August-sown seedbeds were generally of a high standard, but heavy rain during September delayed land preparation so that transplanting of the majority of the crop was delayed until November. December flood rains delayed the completion of transplanting and both necessitated and prevented replanting through waterlogging. Cool, moist weather during January encouraged the development of blue mould but losses from disease and insects were only light. The waterlogged and cool conditions reduced average yields but dry conditions towards the end of the season assisted in the production of reasonable quality leaf.

Varieties

Q46 was the most widely sown variety. It was planted on about two-thirds of the acreage. Other varieties grown commercially were NC95, Sirone and Growers' Hicks.

Extension

During the year, two tobacco research positions at Glen Innes Agricultural Research Station were deleted from the establishment and were replaced by two Tobacco Officer positions (General Division positions) at Inverell. Applicants for these positions had been selected and their appointment was awaited at the conclusion of the financial year. These officers will provide a regular advisory service to tobacco growers.

The two tobacco research agronomists provided an advisory service during 1970-71 as well as fulfilling their research commitments. They made 136 visits to tobacco growers, collected 191 soil samples for analysis and analysed 13 water samples. In addition, extension articles on insect, disease and sucker control were distributed to growers and a new method of irrigation was demonstrated at a field day.

Research

Four different types of seedbed covers were compared for their effect on germination and seedling growth. A clear plastic cover was the most successful and, compared to calico covers, reduced the time required for seedling production by approximately two weeks.

Three levels of water stress were applied to seedlings grown by three different methods. It was concluded that the use of peat pellets for producing and transplanting tobacco seedlings was a feasible agronomic practice. Peat pelleted seedlings were ready for transplanting 35 days after sowing instead of the 60 days needed for normal bare root seedlings.

A travelling irrigator was evaluated against a hand shift spray line. The equipment saved substantial labour and reduced leaf damage but it necessitated a planned layout of the mainline and had a high operating cost. It was unsuitable for pre-transplanting irrigation and had limitations in changing winds.

Investigations into the form and application rate of nitrogen and the application rate of phosphorus and potassium were continued. The form of nitrogen used did not appear to have a significant effect on yield or quality of leaf. Increasing rates of nitrogen increased yields but, although the analysis of results was not complete, leaf quality was apparently poorer at the lowest and highest application rates. The phosphorus and potassium trials were flooded.

Promising new varieties and varieties which have been registered in other states were evaluated. It is expected that revised variety recommendations will be made following the compilation and analysis of the two seasons' results.

The most promising sucker control chemicals used in other states are being evaluated.

Tobacco Mechanisation

A Tobacco Mechanisation Sub-Committee was established at the 25th Meeting of the Central Tobacco Advisory Committee to investigate and report upon all aspects of mechanisation. The sub-committee, which comprised an officer from each of the appropriate N.S.W., Queensland and Victorian Departments, met during the year in Sydney, Brisbane and North Queensland. Reports were presented to the Central Tobacco Advisory Committee and four issues of the "Tobacco Mechanisation News" reporting the sub-committee's activities were distributed by the Department of Primary Industry.

Tobacco Review Panel

It was also agreed at the 25th Meeting of the Central Tobacco Advisory Committee that a tobacco Review Panel should be established to examine the activities of the organizations involved in tobacco research and extension. The panel, comprising Professor N. White, Professor of Plant

Pathology, University of Sydney and Mr N. Halse, Chief, Plant Research Division, Western Australian Department of Agriculture, visited N.S.W. in early December. Except for the then understaffed situation, the panel's comments on the position in this state were favourable.

Australian Tobacco Research Conference

The Australian Tobacco Research Conference was held at Albury in February, 1971, in association with a field session in Victorian tobacco growing areas. Professional staff concerned with the production of tobacco attended. The conference dealt principally with the future of the tobacco growing industry, the methods of producing a product to meet changing consumer demand and, in particular, health aspects of the acceptability of tobacco.

OTHER VEGETABLE OILS

Sesame

Stimulated by reports of overseas demand and a good price, farmers have been inquiring into the possibility of growing sesame. Pilot seed production plots have been sown in N.S.W. for many years but the crop has not been produced commercially. Commercial production is unlikely to occur until more suitable, non-shattering varieties are available for machine harvesting. Seed is being increased to provide sufficient supplies for limited variety testing in the future.

Peanuts

The peanut acreage, which had fallen over the preceding three seasons, improved by about 50 per cent to approximately 350 acres. Peanut production is undertaken in the Lismore-Casino area primarily as a supplementary enterprise to dairying and cattle raising. Production in the area supplies the local edible nut market but makes a negligible contribution to Australian production.

Castorbean

Castorbean is not grown commercially in N.S.W. and the amount of oil imported does not warrant other than the very minor programme of seed increase being undertaken.

OTHER MISCELLANEOUS CROPS

Low prices and marketing difficulties for the major products encouraged primary producers to seek alternative crops and to enquire into the production possibilities of a range of miscellaneous products. Serious enquiries were received concerning the fibre crops, kenaf, flax and jute; the essential oils, peppermint, spearmint and lavender; and the drug crops, opium poppy and *duboisia*. These crops are not considered to have immediate potential. Co-operative work at Yanco Agricultural College and Research Station with the Museum of Applied Arts and Sciences into blue mallee production (for the extraction of cineol) has proceeded to the point where superior lines are to be propagated elsewhere in N.S.W.

Duboisia (Corkwood)

The exploitation of naturally occurring stands of *Duboisia* spp. (for the extraction of hyoscyne and hyoscyamine) on the north coast continued. Increased interest was shown in this plant because of the overseas demand for leaf and the interest of persons having plantation management expertise in establishing themselves in similar pursuits in Australia. Two small plantations have been established.

Digitalis

Digitalis (for the extraction of digoxin) is grown near Gosford. A small acreage may be sown elsewhere in the state because production at Gosford is often adversely affected by heavy coastal rains.

Buckwheat

Small commercial areas of buckwheat were grown on the south west slopes and northern tablelands. Three varieties of buckwheat were sown at Glen Innes Agricultural Research Station for seed increase. The results were unsatisfactory because of the season.

VEGETABLES

GENERAL

Vegetable Production – Shortage, Then Oversupply

The dominant feature of the year was the very wet and humid weather which prevailed in most producing districts from January to March. It made the control of fungus diseases very difficult and also disrupted planting programmes. Consequently, supplies of most fresh vegetables were short from February to April with prices substantially higher than normal. A proportion of the tomato crop intended for processing was diverted to the Sydney fresh vegetable market by inland growers. When the wet weather ceased in late February increased areas were sown, with the usual result of over-supply and poor prices.

Trends of Note

Potato industry. – The rapid progress of the potato crisp industry was maintained early in the year, but then slackened due to general economic conditions. The trend to increased production of potatoes in inland irrigation districts such as Finley, Coleambally, Canowindra and Narromine continued. Generally potatoes from such areas process better than those from coastal districts.

Dry bean production. – Greatly increased interest has been shown by farmers and processors in the production of several types of dry beans. This interest has developed from the greater public awareness of the value of dry beans in the human diet and the resultant increase in demand. Most of the state's requirements had previously been imported from Queensland and overseas. This year increased areas were sown in the Cowra, Dubbo-Narromine and Gunnedah districts. Present indications are that the acreage of dry beans will expand considerably in inland districts with irrigation.

Onion production. – Increased areas of onions were sown in the established production districts as well as in newer areas such as Gunnedah, Bourke, Deniliquin and Coleambally. Greater quantities than normal were exported, mainly to Japan.

Direct seeding. – A strong trend to direct seeding has developed in recent years. It is now practised with tomatoes, cabbage, cauliflower, broccoli and asparagus, as well as with the other vegetable crops normally sown in this manner. The advent of selective herbicides to control weed growth has made direct seeding a much more practicable proposition than formerly.

Packaging. – Changes in the packaging and presentation of several types of vegetables became more pronounced. Fibreboard cartons were used to a much greater extent, particularly with tomatoes, sweet potatoes, zucchini marrows and washed potatoes. Plastic bags also were in more general use for carrots, washed potatoes and other root vegetables. Prepackaging in small lots was most noticeable with carrots and potatoes.

POTATOES

Breeding at Glen Innes Agricultural Research Station

The potato breeding programme continued at Glen Innes Agricultural Research Station. Its aim is to produce new varieties of high quality, of good agronomic type, with satisfactory resistance to a number of diseases and suitable for either or both the processing market and the fresh vegetable trade.

The performance of introduced species and of crosses between them and regular breeding lines of potatoes was notable. Crossbreds resulting from the use of 18 female parent lines of *Solanum stoloniferum* in the breeding programme were grown in the field. Quality of tubers was impressive. A large number of selections were made for further evaluation. Selections were made from the 26 lines of *Solanum andigena* grown. Segregation was substantial and many lines produced very rough tubers. In some cases the purple skin colour was carried through to the flesh of the tuber – these lines were rejected.

In the crossing nursery, a total of 48 female parents, in addition to the 18 *S. stoloniferum* lines and 38 male parent lines were used. Separate crosses totalled 802.

The 2,000 first-year seedlings from 325 separate crosses were screened for common scab resistance. In the later stages of the programme, 300 selections were made from 15,400 second-year seedlings and 80 selections from 714 third-year seedlings. The 160 fourth-year seedlings were grown at the Red Range Sub-Station under difficult seasonal conditions. In the preliminary yield trial, 55 seedling lines were grown; 12 were selected for inclusion in the coming year's trial. Unfavourable weather negated results in the advanced yield trial in which 31 lines were included.

Research at Orange Agricultural Research Station

The research programme at the Agricultural Research Station, Orange was maintained and consolidated. The programme includes the quality assessment of introductions and advanced lines produced at Glen Innes, seed increase of promising lines for evaluation in producing areas and physiological studies related to nutrition, storage and processing quality.

Approximately 300 seedlings from Glen Innes were grown in the glasshouse to supplement the testing normally done at the centre; 900 second-year seedlings were grown in the field and only 15 were retained; 5 third-year seedlings were grown and 3 retained; and 37 seedling lines and 22 varieties were grown for stock maintenance purposes.

Physiological studies were based on a fertilizer trial occupying three acres. The trial was a factorial with four rates of nitrogen, four rates of phosphorus and three rates of potassium. In addition to yield measurements, assessments were made of specific gravity, cooking quality and storage performance. Tubers from all treatments in the trial are still in storage. Regular measurements are being made of reducing sugar content, specific gravity, weight changes and cooking quality.

Potato Seed Production

Certificated Seed Potatoes (N.S.W.) Co-operative Ltd, advised that a total of 782 acres submitted by 81 growers was accepted for certified seed production. Crops were inspected by officers of the Department during the growing season and following bagging. At bag inspection the produce of 3½ acres grown by one farmer at Ebor was rejected for certification because of the presence of powdery scab (*Spongospora subterranea*).

The major varieties certified were Sebago, 568¼ acres; Kennebec, 64 acres; Sequoia, 461½ acres; Exton, 29½ acres and Kurrell, 20½ acres.

Under the Department's approved seed scheme a total of 330 acres submitted by 23 growers passed inspection. The major varieties were Sebago, 219 acres; Kennebec, 42 acres and Bungama, 30 acres. The acreage restrictions imposed in the previous year remained in force.

TOMATOES

Breeding

The breeding programme was continued at Hawkesbury Agricultural College. Three fresh market hybrids were further evaluated with promising results. These hybrids have desirable fruit shapes and resistance to *Fusarium* and *Verticillium* wilts.

Of seven varieties introduced and tested, two were found to be promising. Of these, Tropi Red is self topping and may be useful as a ground crop variety while VF Spring Giant is indeterminate in habit, of similar maturity to the standard early variety, Rouge de Marmande, and possesses resistance to *Fusarium* and *Verticillium* wilts.

Evaluation of breeding lines was continued; 15 selections were made from the lines tested. Most of the selections have resistance to *Fusarium* wilt and some have resistance to both *Fusarium* and *Verticillium* wilts.

Clear Plastic Aids Early Tomato Production

A trial of a clear plastic to give a greenhouse effect was conducted in the Gosford district on an early crop. The results were encouraging — fruit production early in the season was enhanced. Further trials are necessary to confirm that the practice will be economic in most years.

BEANS

Breeding

The breeding programme was continued at Hawkesbury Agricultural College: 21 breeding lines were tested for rust reaction; 47 selections were made from 6 crossbred lines for further evaluation, and 8 introduced varieties were tested.

One of the introductions — Fin de Mont Clar — showed particular promise as a green bean for the fresh market. Seed was increased for district trials. Three lines previously developed at the College were tested in trials in coastal districts. Their performance was better than average. The release of one or more of these lines will be considered after further trials in 1971–72.

A trial of stringless beans for processing was conducted in the Bathurst district. The varieties Cascade, Canyon and Apollo were outstanding with quality superior to the check variety Gallatin 50. These varieties are resistant to summer death disease which has ravaged plantings in recent years.

Seed Production

Although several applications for the certification of crops were received, none was certified because of the adverse season.

CUCURBITS

Stocks of rockmelon advanced crossbred material were maintained.

The pumpkin varieties, Butternut and Crown Prince, increased their popularity on the market during the year. Butternut was introduced by the Department in 1955. It has taken almost 15 years for both varieties to be readily accepted by all sections of the trade.

Hybrid zucchini marrows continued to increase in popularity. In contrast to the two pumpkin varieties, hybrid zucchini marrows have found ready acceptance with consumers.

ROOT VEGETABLES

The sweet potato nursery was maintained at the Tropical Fruit Research Station, Alstonville. Planting material of some varieties was made available to growers at Murwillumbah and Narromine. Trials to evaluate varieties were initiated.

Carrot introductions were tested at Hawkesbury Agricultural College. The variety Ideal, from England, was found to be an excellent type for the fresh market trade. Foram from Holland had good flavour, colour and texture and will be useful for "baby" carrot production. Chantenay Red Cored proved superior to the commercial strain of Chantenay currently in production.

ASPARAGUS

Co-operation was again extended to the Gundagai Asparagus Co-operative Ltd, in the formulation of trials to examine various cultural practices.

LETTUCE

Seed crops for export were again grown on the Murrumbidgee Irrigation Areas. Inspections for varietal purity and freedom from disease were made by officers of the Department.

PASTURES

Research in pastures is carried out at eleven of the Department's research stations and colleges and at nine other locations. The level and distribution of research reflects the great importance of pastures to the animal production industries of N.S.W. Pasture extension work covers virtually the whole of the state apart from the Western Division. This report summarises some of the developments in pasture research and extension in 1970-71.

TRENDS OBSERVED BY DISTRICT AGRONOMISTS

Pastures for Beef Cattle

Because of the big increase in beef cattle numbers there is added extension emphasis on pastures and "feed year" planning for beef cattle, with particular attention to bloat-free species. Lucerne (*Medicago sativa*) is winning increasing support on wheat-sheep-cattle farms. The increase of cattle and the reduction in sheep grazing pressure, in some areas, has had a good effect on the regeneration of "dryland" grass country.

Pasture Establishment

District agronomists report that the efficiency of methods of pasture establishment is being critically examined. In higher rainfall areas the conventional good seedbed has recently been too often displaced by cheaper and riskier methods — possibly justified by current economic conditions and available machinery. Much "old" grazed-out pasture is being replaced in higher rainfall areas with pastures of high density and productivity involving lucerne and perennial grasses. Re-establishment is on a conventional "fine firm compact moist seedbed" without use of cover crop. However, in lower rainfall, wheatbelt areas there has been widespread dependence on cover crop methods, accompanied by a searching review of machines, attachments and techniques to obtain better results in pasture establishment under a crop.

Lucerne Progresses

Lucerne acreage has increased in most parts of the state. The principles of rotational grazing management and high density stocking are gradually gaining acceptance with lucerne growers. Demonstrations of rotational grazing with lucerne have been very useful and successful in lucerne extension, especially when subjected to an economic analysis. The Hunter River variety remains the most widely used. Siro Peruvian and African give good winter production but are not as long-lived as Hunter River.

Reduced Superphosphate Use

Financial stringencies have caused farmers to drastically reduce their expenditure on superphosphate for use on sown pastures and topdressed natural pastures. Reports indicate that reductions have generally ranged between 20 and 50 per cent. On the other hand, increases in the use of superphosphate and sulphur-fortified superphosphate have been reported from a few districts. Among these are Kyogle, Murwillumbah, Taree, Gunnedah and Gilandra. The coastal centres have probably been strongly influenced by rapid beef expansion and by property development by city investors. It is noteworthy, that at Tamworth two-thirds of the topdressed area is classified as natural pasture whilst only one-third is classified as sown pasture.

Nitrogen Fertilizer Use

In coastal areas there has been considerable use of nitrogen fertilizers on grazing oats (*Avena sativa*), kikuyu grass (*Pennisetum cladestinum*), Wimmera rye (*Lolium rigidum*), other short-lived ryegrasses, summer forage crops, broadleaf paspalum (*paspalum wettsteinii*) and paspalum-carpet grass (*Paspalum dilatatum* — *Axonopus affinis*) pastures.

Namoi Woolly Pod Vetch Suited to Poorer Soils

Namoi woolly pod vetch (*Vicia dasycarpa*) has performed well on the tablelands, slopes and plains. It is suited to shallow skeletal soils and poorer sandy soils. However, some officers consider that it may prove to be a potential weed in wheat crops.

Glycine (Glycine Wightii) Losing Favour

Although Tinaroo glycine is being used in frost-free locations on the north coast, glycine varieties generally are being used less than siratro (*Phaseolus atropurpureus*), greenleaf desmodium (*Desmodium intortum*) and lotononis (*Lotononis bainesii*). The high seed price of lotononis and the need to sow it on a well-prepared seedbed are limiting its greater use.

Siratro Popular

Siratro is the most widely used and successful tropical legume on the far north coast of N.S.W. It is adaptable to a wide variety of soils and is tolerant to *Amnemos* weevil damage. It has proved to be a suitable species for aerial seeding on areas that are not infested with carpet grass.

Cocksfoot (Dactylis glomerata) Being Displaced

Currie cocksfoot has performed creditably on the northern and central tablelands but, even so, cocksfoot is being displaced by phalaris, perennial ryegrass and Demeter fescue on the northern tablelands.

Fescue has a Place

Demeter fescue (*Festuca arundinacea*) is finding a place at Glen Innes and in other areas with a summer dominant rainfall. It is also an alternative to phalaris (*Phalaris tuberosa*) on wet sites at Tumut to produce summer feed. Light granitic soils suit this grass but it is not as drought resistant as Currie cocksfoot or phalaris and is more difficult to establish.

Kangaroo Valley Ryegrasses

The former Kangaroo Valley variety of perennial ryegrass (*Lolium perenne*) has now been divided into "late" and "early" varieties, each with individual adaptability to more specific environments and agronomic uses. Both are popular on the central coast.

Phalaris Varieties

Australian. — Australian phalaris maintains favour in cooler higher tableland districts. It is also popular in many other areas on the coast, the western slopes and irrigated areas, particularly for beef cattle grazing.

Sirocco. — Interest in *Sirocco phalaris* has been growing. It establishes faster than Australian and appears to do well in drier wheat areas on the central western slopes. Like Australian, it has also performed well on the tablelands and under irrigation in western areas.

Paspalum

Paspalum has continued as an important naturalised summer-growing grass in coastal and irrigation areas. It is widespread and reappears in carpet grass pastures following application of nitrogen or when soil fertility is increased through the introduction of clover.

Broadleaf Paspalum

Broadleaf *paspalum* has given good results on poor quality hill soils on the north coast under extensive grazing. It has also responded well to nitrogen in pastures for dairy cattle.

Setaria

Setaria (Setaria sphacelata) is proving a useful species on a wide range of coastal soils, especially for beef grazing. However, its use on dairying properties has declined — when adequate nitrogen and phosphorus fertilizers are used on mixed pastures, kikuyu will over-run *setaria*. *Setaria* has been found to be aggressive and difficult to manage in clover mixtures but it associates well with siratro and responds well to nitrogen.

UNIFORM PASTURE SURVEY AND EXTENSION TRIALS (U.P.S.E.T.)

U.P.S.E.T. trials were used less in 1970–71 although their value has been widely acclaimed by district extension officers over the past 10 years. During the year, 214 pre-packaged small plot trial kits were supplied to extension officers: 43 were for trials of rates of superphosphate, potash and sulphur fertilizers, and trace element diagnostic trials; and 171 were designed to test varieties of summer pasture species (33 trials) and winter varieties (138 trials).

PASTURE DEMONSTRATIONS UNDER C.E.S.G.

Commonwealth Extension Services Grant (C.E.S.G.) funds were used to establish 14 demonstrations on pastures.

Subjects demonstrated included: the all-round excellent performance of Hunter River lucerne, both in the west and on the central coast, compared with the shorter-lived Hairy Peruvian and African varieties which give superior winter production; the superior all-year-round production of lucerne compared with that of annual medics (*Medicago* spp.), both grown in association with *phalaris* at Nevertire; the value of broadleaf *paspalum* at three centres and of Pangola grass (*Digitaria decumbens*) at a fourth on the north coast; the productive capacity and drought resistance of *Sirocco phalaris* at five localities in the wheat belt; the value of Merredin annual ryegrass (*Lolium rigidum*) compared with Wimmera rye at Coonabarabran; and the supplementary value of winter pastures as an aid to dairying on the Bulga plateau.

PASTURE RESEARCH

Natural Pastures Research

Grafton. — In a trial on natural pastures used for beef breeding at Fineflower, near Grafton, phosphorus levels in pasture receiving no superphosphate were 0.10 to 0.15 per cent P. Application of 2 cwt per acre of superphosphate raised the figures to a range of 0.20 to 0.25 per cent P. This rate of superphosphate increased dry matter yield by 50 per cent but generally this natural pasture type has shown limited capacity to utilise superphosphate.

Dry matter yield has not varied greatly from 1,400 lb per acre between years despite varying seasonal conditions but yield has suffered under the stress of frequent defoliation. Under superphosphate treatments over three years there has been a slow build-up of native legumes in the natural pasture.

Burren Junction. — The growth curves of natural pastures (curly Mitchell grass associations — *Astrebula lappacea*) and grazing lucerne have been studied over three years at Burren Junction. They have been shown to be complementary to a large extent.

Shannon Vale Nutrition Research Station. — In a project at Shannon Vale, near Glen Innes, the effects of high and moderate sheep stocking rates in combination with topdressing with superphosphate levels of 0, 2 and 4 cwt per acre on the composition, persistence and productivity of a natural pasture oversown with white clover (*Trifolium repens*) are being studied. Over two years there have been relatively few ecological changes. However, a significant increase in white clover in the topdressed treatments is now apparent and 2 cwt per acre of superphosphate is currently producing better yields of wool and stimulating clover development more than 4 cwt per acre.

Tamworth. — A pilot trial at Tamworth Agricultural Research Station has indicated that the productive potential of natural pastures is well above that previously suggested. The potential is only realised in the presence of adequate sulphur which greatly influences medic growth. Stocking rate also has exerted a significant influence of profitability. It has been concluded that a conservative stocking rate of four dry sheep equivalents per acre is the optimum on topdressed natural pastures such as these.

Trangie. — In a trial at Trangie Agricultural Research Station: natural annual pastures have supported a set stocking rate of two wethers per acre for three and a half years without any hand feeding; lucerne and natural perennial pasture have been ineffective as supplements to the natural annual pastures in increasing wool production per head; stocking rate has had a marked effect on the botanical composition of the natural annual pasture; and a high density of barley grass seed heads at low stocking rates has been associated with depressed liveweights, and also with lowered wool production per head in some seasons. At high stocking rates barley grass (*Hordeum leporinum*) has been suppressed and natural medics (*Medicago* spp.) and crowfoot (*Erodium crinitum*) have gained dominance. (See also the report "pasture management and utilisation research — stocking rates at Temora").

Breeding ewes have now been introduced to the trial to provide a more sensitive assessment of pasture productivity and to produce results that are more applicable to the general farming and grazing pattern of the area.

PASTURE SPECIES AND CULTIVAR RESEARCH

Notes from Some of the Research Stations

Grafton. — Following the provision of a small all crop harvester, good progress has been made with seed increase of promising species, especially with *Aeschynomene falcata*, *Stylosanthes guyanensis*, *Lespedeza striata*, *Paspalum notatum* and the native *Glycine* species P7877.

Condobolin. — In initial screening of a range of introductions the *Medicago* species showed special promise — especially the early flowering barrel medics (*M. truncatula*). These results confirm earlier work.

Narrabri. — The need for more productive winter and spring pastures to supplement the usually adequate summer-autumn forage supply is now emerging as a main objective in the species programme at this centre. A preliminary trial has been arranged to evaluate 90 annual legume species in the north west environment.

Cowra. — Lucerne has been shown to have the best potential for improving the "feed year" for grazing animals in the Cowra district. This species has generally improved the annual total dry matter yield but more importantly has dramatically increased summer production with feed of high quality. Hunter River has been the most consistent variety with Siro Peruvian producing better in the cooler months.

Trials have shown that the introduction of perennial grasses at Cowra is justified only after fertility has been built up with annual subterranean clover-based pastures and superphosphate has reached the cumulative level of 5 to 10 cwt per acre.

Leeton. — At Leeton, hybrid phalaris had a higher annual yield than Seedmaster *Phalaris tuberosa* in irrigated pastures. Its production was outstanding in autumn and spring. Pure phalaris swards fertilized with nitrogen at Leeton outyielded phalaris/white clover and phalaris/lucerne mixtures.

Notes on Particular Species and Genera

White clover (*Trifolium repens*). — At Berry, two introduced white clover varieties, C.P.I. 19433 and C.P.I. 19434 (from Mediterranean sources), yielded much better in winter than Ladino and other varieties tested.

The value and persistence of the naturalised Clarence Valley white clover ecotype has been clearly demonstrated in a grazing trial at Grafton. Seven acres have been sown for seed increase.

The variety Haifa, derived at Grafton from an introduction C.P.I. 15648 (P.354) from Israel, was registered and basic seed production was commenced. Haifa has superior heat tolerance, productivity, persistence and seeding ability on the low-fertility soils of the Clarence Basin. It and a related variety Tamar are being tested against "Clarence Naturalised" and commercial varieties in trials at Grafton, Taree, Maitland, Berry and Leeton.

Lucerne (*Medicago sativa*). — At Temora, lucerne has been able to maintain four breeding ewes per acre. At Tamworth, lucerne carried six dry sheep per acre for three years without introducing feed into the system.

Studies of root and crown formation in various varieties of lucerne at Narrabri indicated little difference between them. Plants of Cancreep did not show any particular ability to creep under irrigation. This variety developed tap roots as did Hunter River and other varieties in the trial.

In a joint CSIRO — Department of Agriculture breeding project 28 superior creeping-rooted lucerne plants were selected from nurseries at Narrabri and transferred to Canberra.

Medics for the drier central west. — Trials at Condobolin Agricultural Research Station have confirmed Jemalong barrel medic (*Medicago truncatula*) as the most productive annual medic. At Mt Hope dry matter yields and seed set of Hannaford have been consistent over three years of trial; however Cyprus has consistently given the heaviest seed set and is recommended in the Mt Hope environment.

African clovers. — On the coarser-textured soils of the Upper Clarence Valley the African clovers, Kenya white clover (*Trifolium semipilosum*) and Burchell's clover (*T. burchellianum*), gave the highest yields of legume dry matter. However, Woogenellup subterranean clover (*T. subterraneum*) induced highest yields of native and naturalised grasses.

Stylosanthes spp. — *S. guyanensis*, C.P.I. 11493, is the most promising of the *Stylosanthes* introductions on the north coast.

Aeschynomene falcata (joint vetch). — *Aeschynomene falcata* is well-adapted to low fertility soils of the beef breeding areas of the Clarence Valley.

Phalaris hybrid Siro 1146. — A new hybrid phalaris, Siro 1146, has given good results on the coast, tablelands and slopes and in western irrigated areas. It has demonstrated good summer growth and could be especially useful in beef cattle areas of the northern tablelands. It has also given promise of providing an ecological control of *Eragrostis* spp. in sown pastures on the northern tablelands.

Digitaria spp. — A *Digitaria* species trial was begun in co-operation with the CSIRO Division of Tropical Pastures to compare a range of *Digitaria* selections throughout south eastern Queensland and north eastern N.S.W. The objective is to release a seeding variety of *Digitaria* to complement or replace Pangola grass in the subtropical environment of eastern Australia.

Kikuyu grass (*Pennisetum clandestinum*). — At Maitland a comparison between Whittet kikuyu and "common" kikuyu from Maitland and Grafton did not show any significant difference in yields. Research with kikuyu grass continued at a number of coastal locations. It was concerned with such aspects as nitrogen fertilizer response, potential for milk and beef production, "yellow disease", legume association, growth pattern, conservation, feed quality, winter grass associates and grazing management.

Research with ball clover (*Trifolium glomeratum*). — Pastures sown 10 years ago at the CSIRO Ginninderra Research Station (at Canberra) now have ball clover as a major component, following grazing at the high stocking rate of 14.8 sheep per acre. Research by an officer of the Department working under the direction of a CSIRO senior principal research scientist at Canberra suggests that ball clover is now the most widespread and most common legume in natural and improved pastures in south east Australia.

There is considerable variation between lines of ball clover but there is stability within lines. This species has good potential in marginal subterranean clover areas and under high stocking rates at which subterranean clovers do not survive. It is free of undesirable burrs, grows naturally, responds well to superphosphate, is palatable and seeds prolifically, even under high stocking rates and some ecotypes grow in drier areas. Its major disadvantage is poor winter production.

PASTURE ESTABLISHMENT RESEARCH

Establishment under cover crops. — It has been shown on the southern tablelands that phalaris and lucerne pastures can be successfully established under a range of cover crops — winter cereals, oilseeds, grain legumes and summer forage crops. Severe grazing of the cover crops reduces plant populations of undersown phalaris and lucerne. Generally however, moderately grazed cover crops have had only a small effect on pasture establishment.

Wheat, oats, barley and linseed are under trial as cover crops for lucerne and barrel medic in the central west.

Chemical seedbed preparation. — Chemical seedbed preparation before sodseeding phalaris and lucerne has given good results in several tableland districts.

Aerial establishment of pastures on skeletal soils. — On the southern tablelands Namoi vetch, golden tares (*Vicia sativa*), wimmera ryegrass and crimson clover (*Trifolium incarnatum*) established well when aerially sown into a native tussock pasture on a skeletal soil. Establishment was successful on a southerly slope both on untreated pasture and pasture treated with herbicide. Establishment was not as good on a less favourable north-westerly slope. Large seeded pasture legumes such as those tested have possible value for cheap pasture establishment in pioneering situations.

Aerial pasture sowing. — On the central tablelands results of aerial sowing have been impressive only where control of competition from serrated tussock and native grasses has been obtained by 2,2-DPA spraying. In other cases, dry seasons and native grass competition have resulted in unsatisfactory and unreliable establishment, especially of perennial grasses.

PLANT NUTRITION RESEARCH

Some of the interesting work in this field is proceeding at the following centres.

Grafton. — The work at Grafton is primarily directed at the development of a phosphorus soil testing service to aid pasture improvement on the low fertility soils of the Clarence Valley. This work is co-operative with the Chemistry Branch.

Rydalmere. — Glasshouse pot work at Rydalmere is mainly concerned with manganese and aluminium toxicities in soils and the ameliorating effects of lime. Supporting field work is going on at several country locations. Another project at Rydalmere seeks reasons for low responses to superphosphate on improved pastures with a long superphosphate history in the Albury district.

Muswellbrook and Tamworth. — Glasshouse pot trials and related field trials have been used to establish fertilizer needs on soils in the Upper Hunter district. In a training project at Tamworth, plant nutrition studies have been conducted on "problem" coarse granite soils of the Bendemeer district.

Condobolin. — Research is in progress to investigate the possible importance of "positional unavailability" of superphosphate when surface topdressed onto pastures in lower rainfall areas.

PASTURE MANAGEMENT AND UTILISATION RESEARCH

Lucerne management studies at Tamworth. — Lucerne management systems are being investigated at Tamworth to ensure that practices conform with the physiological requirements of the plant. Factors being investigated include frequency and intensity of defoliation, length of "rest period", number of paddocks in the rotational grazing system and stocking rate.

It is evident that the longer the time interval from the beginning to the end of defoliation, the lower the subsequent yield.

Lucerne rotational grazing experiment at Temora. — Stocking rates of two and four ewes per acre were compared in a lucerne management trial at Temora. Satisfactory lamb growth rates were obtained under rotational grazing using both five and seven paddock systems. Better growth rates were obtained if lambs were able to "creep forward" ahead of the ewes into the next paddock or if the rate of rotation was increased between lambing and weaning.

Important factors in management to retain lucerne plant density and maximum production include: avoidance of set-stocking; eating out in six to ten days; allowing regrowth of 35 to 45 days; use of five to eight paddock systems to permit these conditions of grazing and spelling to be achieved; and allowing all stands to flower at least once each year — preferably in early spring.

Results at both Tamworth and Temora have indicated that lucerne should be grazed right down, then spelled, rather than be partially utilised thus allowing regrowth from old stems.

Grass-clover balance – cattle bloat research. – A pasture management research programme carried out by an officer of the Department working under the supervision of the Professor of Agronomy at the University of New England during the past four years has been completed. The programme was aimed at developing grass-dominant, sown pastures as a means of preventing bloat which is a serious problem in beef cattle on the northern tablelands. The project was financed from funds provided to the University by the Australian Meat Research Committee.

The following principles were established to promote the rapid development of grass-dominant sown pastures:

- * The establishment of grasses with clovers at sowing;
- * The use of high rates of superphosphate – 2–3 cwt per acre for up to three years after sowing; and
- * Efficient utilisation of the herbage produced.

It was also shown that gain in liveweight is reduced by 20–30 per cent in pastures with a high clover content. The reduction was attributed to a depressive effect of sub-lethal bloat on herbage intake.

Stocking rates at Temora – Increased stocking rates at Temora resulted in some large increases in wool and lamb production but they emphasised seasonal feed shortages, especially in the summer. Lucerne has been of great value under these circumstances as a special purpose pasture for flushing ewes or feeding ewes and lambs and also for finishing prime lambs. Management experiments have shown that lucerne can be used to dramatically increase stocking rate in the Temora area.

Results at Temora have shown that botanical composition of southern wheat belt pastures can be controlled by superphosphate application and grazing pressure to maintain a desirable balance between subterranean clover and barley grass. (See also the report under the heading “natural pasture research – Trangie”).

Barrel medic – lucerne x superphosphate rates grazing trial, Condobolin. – At stocking rates of 1.5 and 2.5 dry ewes per acre positive sheep liveweight responses were obtained to increasing superphosphate rates from nil through 1 cwt to 2 cwt per acre. Greasy wool production per head showed no response to increased superphosphate application but increased stocking rate resulted in increased wool production per acre.

Jemalong barrel medic pasture, Trangie. – A Jemalong barrel medic pasture has carried up to 2.75 breeding ewes per acre for the past 14 months at Trangie without the sheep being stressed in any way. The role of medic burr in the late summer and autumn nutrition of sheep has been highlighted. Little of the barrel medic burr has been caught in the wool.

Kikuyu grass x nitrogen x weaner beef experiment, Wollongbar. – A weaner-beef production experiment is in progress at Wollongbar on a mixed kikuyu-paspalum and carpet grass pasture. The effects of a number of levels of nitrogen fertilizer and appropriate scales of stocking rate are being measured in terms of liveweight gain made by beef weaner cattle.

Results in the first year give beef production gains as high as 942 lb per acre.

Beef cattle on natural and improved pastures, Grafton. – Beef cattle production from three pastures on low fertility country at Grafton was compared. The pastures, grazed by Hereford cows and their calves, were: natural pasture; naturalised pasture oversown with naturalised white clover; and natural pasture topdressed with superphosphate and oversown with Ladino white clover, lotononis and *Lespedeza striata*.

The nutritional advantage to breeding cows and calves of the two improved pastures over the natural pasture was reflected in higher carrying capacities and higher body weights of cows and better growth curves of calves.

Summer grasses for milk production, Wollongbar. – In initial trials, Pangola and green panic/Rhodes grass (*Panicum maximum* var *trichoglume*/*Chloris gayana*) have given highest milk production when fed ad lib.

Berry milk production trials. – Grazing evaluation trials for milk production are now in progress at Berry comparing the phalaris hybrid, Siro 1146, Kangaroo Valley ryegrass, kikuyu and paspalum.

Comparison of summer pastures, Wollongbar. – Butterfat production from four summer-growing pasture treatments is being compared at Wollongbar. The treatments are: kikuyu plus nitrogen; kikuyu plus tropical legume; kikuyu-based natural pasture; and a carpet grass-dominant pasture.

Cows produced more when white clover was present in the pasture and production per acre was also increased.

Results in butterfat production per acre per day demonstrated the large potential for increased production through the use of nitrogen but these increases may not necessarily be economic. During mid-summer, natural pasture can supply adequate feed on most farms. However, it is obvious that other sources of feed, such as forage crops, conserved fodder or bought-in feeds, may be required in spring and autumn.

Feed year trial, Temora. — In a “feed year” trial at Temora, the main comparisons are related to the basic wimmera rye-subterranean clover pasture of the area. Additives to this basic pasture include lucerne, grazing oats, Sirocco phalaris and combinations of these species to make up six feed year systems in all. The stocking rates are 3.6, 4.8 and 5.6 ewes per acre.

In the first year, sheep at the higher stocking rates of 4.8 and 5.6 ewes per acre required hand feeding on wimmera rye-subterranean clover pastures from the first week of June, whilst the sheep on the lucerne and phalaris-based pasture did not need supplementation. There was an outbreak of “staggers” on Sirocco phalaris treatments due to the combined effects of a dry autumn, a dense phalaris stand and the shading and clover-suppressing effect of the old stalks of phalaris.

PASTURE SEED PRODUCTION

Declining Production Evident

The production of 2,338 tons of certified seed in 1970–71 was in marked contrast to the 3,640 tons produced in 1969–70. Seed growers were reluctant to continue production on the same scale because of large stocks of carry-over seed and reduced demand from a depressed pastoral industry.

The build-up in stocks of certified seed was responsible for a further decline in the production of uncertified seed — only 1,130 tons were produced.

Seasonal conditions in the south and central west of the state were generally favourable for seed production but summer rains reduced yields in some southern districts. On the northern tablelands and in the north west above average rainfall and floods severely curtailed production.

In contrast to the general decline in production there was a substantial increase in the production of certified seed of Geraldton subterranean clover from 7 tons in 1969–70 to 250 tons in 1970–71. The production of Hunter River lucerne seed also increased, from 186 tons to 421 tons.

Certified Seed Production

Subterranean clover (*Trifolium subterraneum*). — Certified seed production of all subterranean clover cultivars (varieties) totalled 1,623 tons of which 1,074 tons were of Woogenellup and 250 tons of Geraldton. There was a significant decline in the production of seed of both Mt Barker and Bacchus Marsh.

The bulk of the seed was produced in the Southern Region where some areas of Geraldton yielded in excess of 1,000 lb per acre.

An outbreak of “Scorch Disease” or “Northern Anthracnose” caused by the fungus *Kabatiella caulivora*, reduced seed yields particularly in areas of Woogenellup.

Barrel medic (*Medicago truncatula*). — The production of 67 tons of certified seed of barrel medic was comprised exclusively of the variety Jemalong. Most of this was produced in the central west on areas sown specifically for seed production. Yields greater than 400 lb per acre were recorded.

Lucerne (*Medicago sativa*). — Although introduced only last year, the lucerne seed certification scheme has gained wide acceptance. So far this season some 421 tons of seed have been produced. The principal seed producing areas are in the Western and Mid Western Regions. Crops in the Western Region suffered from moisture stress, poor insect pest control and an absence of pollinating insects which resulted in generally poor yields and some crop failures. In the Mid Western Region yields were well above average — a number of areas produced two seed harvests.

Perennial ryegrass (*Lolium perenne*). — Seasonal conditions in the Nowra-Kangaroo Valley area were generally favourable for seed production although summer rains damaged some late crops and 121 tons of certified seed of the Kangaroo Valley Early and Kangaroo Valley Late cultivars were produced. This was the first occasion in which seed of the former Kangaroo Valley variety was certified as two distinct varieties.

Phalaris (*Phalaris tuberosa*). — There was a substantial decline in the production of seed on the N.S.W. cultivar of phalaris — only 31 tons of certified seed were produced compared with 74 tons in the previous year. Reduced production was due to the reluctance of the producers to add to large carry-over stocks and to unfavourable harvesting conditions on the northern tablelands. For the same reasons the production of seed of Seedmaster was down to 11 tons as compared with 43 tons in the previous year.

The acreage sown to Sirocco for seed production has expanded to meet the increasing demand for seed. In spite of unfavourable harvesting conditions in some areas, 20 tons of certified seed were produced compared with 15 tons in 1969–70.

Tall fescue (*Festuca arundinacea*). — The production of 36 tons of certified seed of the Demeter cultivar was only half the previous season's production. The reduction was due partly to the adverse market situation and partly to unfavourable seasonal conditions on the northern tablelands.

Cocksfoot (*Dactylis glomerata*). — Production of certified seed was 6 tons of Currie cultivar and 3½ cwt of Brignoles cultivar.

Broadleaf paspalum (*Paspalum wettsteinii*). — Certified seed production is restricted to several growers on the north coast who produced a total of 2½ tons.

Uncertified Seed Production

Seed cleaning establishments throughout N.S.W. provided statistics which indicated that some 1,130 tons of uncertified seed were processed during the year. The principal species were: Lucerne — 361 tons; subterranean clover — 194 tons; Wimmera ryegrass (*Lolium rigidum*) — 189 tons; paspalum (*Paspalum dilatatum*) — 108 tons; and carpet grass (*Oxonopus* spp.) — 94 tons.

Kikuyu Grass (Pennisetum clandestinum) Seed Production

The first production of kikuyu grass seed on a commercial scale was undertaken by two producers at Coffs Harbour and one at Quirindi. The enterprise was made possible by the discovery of the free-seeding variety Whittet and the development of seed production techniques at Grafton Agricultural Research Station.

The Department has established a seed certification scheme to ensure the production of quality seed of Whittet kikuyu based on mother seed produced from the three areas now established. Certified seed is expected to be available in 1972.

Bulk Handling of Pasture Seed

A large quantity of the pasture seed harvested in the Southern, Mid Western and Western Regions was handled in bulk from the paddock to the seed cleaning plant. This development expedited the handling of seed and reduced costs of processing. The principal seed cleaning establishments in these regions provided suitable bulk storage and handling facilities.

N.S.W. Herbage Plant Liaison Committee

The N.S.W. Herbage Plant Liaison Committee includes representatives of merchants and seed producers as well as plant breeders' organizations. It met twice during the year and continued to play a significant role in the registration, release and seed multiplication of new varieties of herbage plants.

National Co-ordinating Committee for Seed Certification

In response to recommendations from Herbage Plant Liaison Committees representing the various states, the Australian Agricultural Council approved the establishment of a National Co-ordinating Committee for Seed Certification. The purpose of the Committee is to co-ordinate the maintenance of genotype and the production of basic seed of Australian herbage plant varieties and to establish uniform standards for seed certification throughout Australia. The Committee will also act as a co-ordinating body for O.E.C.D. seed certification activities. This role resulted from Australia gaining membership during the year of the Organization for Economic Co-operation and Development Herbage Seed Certification Scheme.

The Committee held its initial meeting at Canberra in February 1971. The Committee is supported by a sub-committee, The Australian Seed Industry Advisory Committee, which consists of representatives from the seed industry.

Commercial Organizations

The Department continued to have excellent co-operation and liaison with the N.S.W. Seedgrowers' Association, the Seed Industry Association of Australia and the N.S.W. Seed Increase Committee. Seed industry organizations are developing a plan for the orderly production and distribution of basic seed throughout Australia. The plan draws largely on the experience of the N.S.W. Seed Increase Committee.

Seed Certification Inspections

The eight seed production officers located at the main seed producing centres, together with district agronomists, carried out field inspections of seed crops of which 35,617 acres were approved for seed production. Some 2,338 tons of certified seed were produced from this area.

Import and Export of Seed

More than 1,010 tons of seed entered Australia through N.S.W. in the 12 months to March 31, 1971. The principal species imported were ryegrass, white clover and red clover from New Zealand. Grass seed for lawn sowings was also imported in considerable quantities.

Although precise figures are not available there was some increase in the quantity of seed exported. Species included subterranean clover, cocksfoot, paspalum and carpet grass.

Seed Marketing

Seed producers had difficulty in selling pasture seed because of the continuing high level of seed stocks of the popular varieties and the depressed state of the pastoral industry. Efforts to find export markets increased but did not have much success. Some seed prices fell and many seed producers sought alternative, more profitable enterprises.

Inspections Under Various Acts

Inspections throughout the state under the Agricultural Seeds Act, Stock Foods and Medicines Act, Pest Destroyers Act, Fertilizers Act and Veterinary Surgeons Act were continued by three inspectors. They visited 86 towns and suburbs, made routine inspections of 303 stores and 226 special visits during which 335 samples were taken.

Unregistered products detected included 142 stock medicines, 60 stock foods, 12 pest destroyers and 5 fertilizers. Warnings were sent to those marketing unregistered products in N.S.W.

The inspectors also completed certification procedures on seed forwarded to Sydney for processing.

Agricultural Seeds Act

Work continued on a major revision of the Agricultural Seeds Act and regulations to establish conformity with other states.

SEED TESTING LABORATORY

Laboratory Staff and Training Matters

The laboratory commenced 1970-71 with six of its 19 established technical positions vacant and ended it with seven positions vacant. There were five resignations and four appointments and an accumulated loss of 311 man-weeks due to long standing vacancies and recruitment problems.

Stock Foods and Medicines Act Regulations

Work on the revision of the seed and grain schedules of the regulations was completed.

Work Statistics

There was a 2.5 per cent decrease in the number of samples received by the seed testing laboratory. Of the 2,781 samples received, 351 were examined on behalf of the Commonwealth Quarantine Authorities, a reduction of 17 per cent, from the previous year.

The 607 samples of certified pasture seeds tested were less than the 900 samples in 1969-70 but more than the 590 in 1968-69 and the 480 in 1967-68. The differences show the effect of seasonal and price variations on certified seed production. Samples submitted under the Maize, Sorghum and Bean Seed Certification Schemes, involving the more specialised seed grower, decreased

from 450 in 1969–70 to 416 in 1970–71. Of the remaining samples, 15 were tested on behalf of the rice industry, 798 were submitted by officers of the Department, 432 represented uncertified seed lines which were to be offered for sale, 121 consisted of seeds for identification, and 41 samples were of regulatory origin.

The major work of incorporating four overseas seed collections into the laboratory's reference seed collection and rehousing the 8,000 reference slides was completed.

Tests and technical assistance were provided to seed firms, farmers, members of the public, the Police and Railways Departments, Soil Conservation Service and the Department of Customs and Excise.

FODDER CONSERVATION

GRAINS

Oats

The 1970–71 production of oats has been estimated at 25,000,000 bushels which is about the average of recent years. These reserves of oats together with good pastoral conditions until autumn 1971 resulted in low prices to farmers. Grain sold on the farm from late October 1970 to early February 1971 averaged about 35 cents per bushel. The price previously averaged about 45 cents.

Barley

Production of barley for 1970–71 has been estimated at 18,900,000 bushels – 53 per cent more than the previous year. More barley is being used as a stock feed with excellent results. Prices varied between 47 and 66 cents per bushel from November to April and between 59 and 72 cents from May to October.

Purchasing of Oats and Barley "Off the Header"

Prices of oats and barley have constantly been at their lowest at harvest and highest in the several months preceding harvest. This pattern is leading increasing numbers of farmers, especially those in coastal areas, to purchase grain "off the header" at a considerable saving.

Maize

It has been estimated that 1970–71 production will be about 4.7 million bushels or almost 750,000 bushels more than in 1969–70. Maize prices ranged from 77 cents to \$1.12 per bushel, with an average of about 85 cents.

The use of maize as a feed for dairy cattle on the coast continued to expand. It is used mainly in the form of corn and cob meal which provides lower protein than the grain alone but is an excellent source of energy.

Sorghum

The 1970–71 sorghum production has been estimated at 18,000,000 bushels. Of this about 12,000,000 bushels was taken into storage by the N.S.W. Grain Elevators' Board for export. The price received by farmers ranged from \$21.50 to \$33 per ton. The August to February average was about \$31 to \$32 per ton and the March to July average about \$24 per ton.

Wheat

The wheat harvest for 1970–71 yielded about 111,000,000 bushels. Larger than usual quantities were weather damaged. Approximately, 3,000,000 bushels were sold by the Wheat Board as stock feed. Many farmers held large carryover stocks of wheat from the 1969–70 harvest but, due to the shortfall in the 1970–71 harvest and to private sales, these stocks have been practically eliminated.

HAY

It is estimated that hay stocks exceeded 2,600,000 tons. Very heavy rain in summer in many areas impeded haymaking. Much hay was damaged and in some cases it was impossible to mow areas intended for hay. Ultimately, much of the surplus growth was made into silage. Demand for hay was light for most of the year due to the availability of reasonable quantities of paddock feed and large stocks of oats at low prices.

Lucerne Hay

Estimated production of lucerne hay in 1970–71 was 750,000 tons — nearly 100,000 tons more than in the previous year. The increase in production was stimulated by increasing beef cattle numbers. Farm prices ranged between \$15 and \$25 per ton, depending on quality.

Pasture Hay

Production of pasture hay in 1970–71 has been estimated at about 500,000 tons. Not much was sold; prices were generally \$3–\$5 per ton lower than for lucerne hay.

Oaten Hay

The estimate of the 1970–71 production of oaten hay is about 114,000 tons. The price varied from \$8 to \$12 per ton but sales were slow until the autumn. The cost of producing oaten hay has risen to about \$10 to \$12 per ton, so production is limited to that required for farm use.

Wheaten Hay

Production of wheaten hay in 1970–71 has been estimated at about 64,000 tons. The cost of production, sale price and sales pattern for wheaten hay were similar to those for oaten hay.

SILAGE

It is estimated that silage reserves at the conclusion of 1970–71 exceeded 750,000 tons. The rather wet summer provided many areas of the state with surplus feed but at the same time prevented many farmers from making hay. Some of the surplus was made into silage. The usual crops, pastures, and even weeds were used for silage.

The cost of haymaking at \$10 to \$12 per ton was another factor prompting farmers to make silage. In many cases surplus feed was ensiled for around \$1 per ton. When crop costs were included, the total cost was between \$4 to \$4.50 per ton. At this price silage is cheaper in feed value than hay although it is not as readily marketable. There was an increase in the use of silage for production feeding and particularly as a winter supplement for cattle rather than as a drought reserve.

OTHER ASPECTS OF FODDER CONSERVATION

Fodder Reserves

The Statistician's figures were not available when this report was prepared but it is estimated that fodder reserves at the end of the year would provide eight weeks' feed for all stock in the state. This estimate is slightly higher than the seven and a half weeks' reserve estimated to be held in the previous year.

Grain Drying

As grain production has expanded in recent years, harvesting and storage techniques have changed. Interest in grain drying has developed because of the Grain Elevators Board's insistence on the moisture content of wheat not exceeding 12 per cent and because of the rapid increase in sorghum and maize production. There are now grain drying facilities in most grain producing areas of the state.

Extension

Commercial firms have continued to show interest in grain storage, grain drying, silage making, machinery, additives to silage, hay and grain and the pelleting of lucerne. There are now four lucerne pelleting plants in N.S.W. and a fifth is being built.

Research on High Moisture Grain Storage

In a trial at Kempsey beginning in October, 1970, the moisture content of samples of dry maize, oats, barley, sorghum and wheat was increased to 25 per cent moisture. The samples were then placed in airtight storages. When the containers were opened in April, 1971, all grains appeared to have stored well. The samples are now being used in a pig feeding trial and the "high moisture" stored grains are increasing pig weights faster than "dry" grain.

Hay Handling

Research began at Glenfield on a study of handling baled hay in co-operation with the Agricultural Engineer. The main line of enquiry will be the use of half length bales and random or tumble stacking. If successful, this method would allow two men to handle a hay harvest.

IRRIGATION

Special Agronomist (Irrigation)

The appointment of a Special Agronomist (Irrigation) at Leeton has resulted in a big improvement in services from the irrigation section. He has assisted officers in the South Western Region and has also advised officers in the Macquarie Valley and the Moree area in relation to irrigation development. In addition the special agronomist has helped in extension programme planning and publication of results, has served on committees and has effected a close liaison with agronomists engaged in irrigation research.

Irrigation Development – General

The area under irrigation in N.S.W. has expanded slowly. Farmers have continued to develop underground water reserves in several areas and diversification of cropping has followed. In many districts spray irrigation from surface dams, bores and streams has been used as supplementary irrigation.

On the Murrumbidgee Irrigation Areas in the past season falling returns for rice, fat lambs and other products resulted in more care in planning of farm programmes and also in a sharp reduction in the amount of water used for irrigation. Preliminary reports for the watering season ended May 1971 indicate that the volume used was down by 50 per cent. The steep decline in water used in autumn 1971 for the establishment of annual winter pastures and fallow watering was particularly noticeable.

Macquarie Valley

The Macquarie Valley, where much of the irrigated area is watered by means of channels and off-river pumping schemes, has been experiencing a difficult period. Severe losses were caused by a mice plague in 1969–70 and by floods in 1970–71. These two catastrophes, following the initial expense of irrigation establishment, have restricted further irrigation development in this region at a time of falling prices and increasing costs.

Gwydir Valley

Completion of Copeton Dam on the Gwydir River is scheduled for early 1973. Farmers' interest in this proposed development has continued to increase and has been fostered by the Department.

Pindari Dam

Since the completion of the Pindari Dam on the MacIntyre River with a storage capacity of 30,000 acre feet, only minor expansion in irrigation has taken place involving a few tobacco growers. This lack of interest is attributed to the high costs of diversification of farming enterprises combined with the present rural recession.

Application for Advances Under the Farm Water Supplies Act

The co-operation of most district agronomists was required in handling 98 applications for advances of more than \$4,000 under the Farm Water Supplies Act. There were 96 applications in 1969–70.

Irrigation Research

The irrigation research agronomist at Leeton Agricultural Research Station resigned. The second irrigation research agronomist completed post-graduate training with the CSIRO Division of Irrigation Research Station at Griffith and is about to take up duty at Leeton Agricultural Research Station. His research project at Griffith, "evaluating the efficiency of irrigation methods using tomatoes as a test crop", is in its final stages. Preliminary analysis of results has indicated that there was no significant difference in the marketable yield of tomatoes between trickle and furrow irrigation when the same amount of water was applied at the same frequency.

Another research agronomist conducted research into irrigation layout for summer coarse grain crops at Leeton Agricultural Research Station. The first year's results indicated that, provided good management is employed, the type of layout has little influence on yield on the Gogeldrie clay soils.

Trickle Irrigation

Investigations into the adaptability of various trickle irrigation systems to N.S.W. conditions continued. Private development of trickle irrigation continued in a number of fields. There are large vine projects in the Pokolbin area and, on the north coast, an area under macadamia nuts has been established under this system of irrigation. Many small growers have used trickle irrigation with strawberries, tomatoes and passionfruit in the central coast and the metropolitan area. It appears that most operators are still experiencing problems with installation and filtering.

Cloud Seeding

During the second year of the experimental cloud seeding project, 207 flights were made totalling 469 hours, 30 minutes. Seeding took place during a total of 238 hours, 14 minutes. Analysis of the first year's results is now in progress with co-operation from the Biometrical Branch and the CSIRO Division of Radiophysics.

WEEDS

Control Programme for Galvanised Burr (Bassia burchii)

Following an increase of \$150,000 in the Government grant for noxious plant control a co-ordinated programme of galvanised burr control was commenced in western areas. Pastures Protection Boards were given an opportunity to participate in the grant for the first time. They are co-ordinating their galvanised burr control work with that of Councils.

The Noxious Plants Advisory Committee

The Noxious Plants Advisory Committee continued to co-ordinate noxious plant activities of the Departments of Agriculture, Local Government and Lands. The Principal Agronomist (Weeds) is chairman of the Committee.

The Government grant of \$600,000 to assist Councils and some Pastures Protection Boards to implement specific noxious plant control programmes was an increase of \$150,000 over the previous year. An amount of \$97,000 was allocated to galvanised burr control with \$2 being provided from the Government grant for each \$1 provided by local authorities. There was an allocation of \$4,000 to the Western Lands Commission to initiate a programme designed to control mesquite (*Prosopis* spp.) in an unincorporated section of the Western Division south of Broken Hill.

Allocations to Councils for control of weeds other than galvanised burr continued to be \$ for \$ in the Eastern and Central Divisions of the state and \$2 for \$1 in the Western Division. Special amounts were allocated for the treatment of weed infestations on vacant Crown Lands and for the purchase of specialised equipment.

Problems of weed control on the state border were discussed with the Queensland departments of Lands and Primary Industries.

The noxious plants lists for the state are still being revised. It is expected that this task will be completed during 1971-72, twelve months earlier than the previous forecast.

Extension - Weeds

Two galvanised burr demonstrations were established using Commonwealth Extension Services Grant funds and more are planned.

Weeds displays were exhibited at agricultural shows at many country centres.

There is a shortage of information about herbicides suitable for the control of specific weeds in alternative crops to wheat such as rapeseed, sunflower, grain sorghum, lupins and small seed crops.

Owing to the difficult rural economic situation a tendency has developed to select areas with low levels of weed infestation or to depend on mechanical control with existing implements rather than to use herbicides.

Inspections

Reports were compiled on a number of surveys by field officers (weeds). They included galvanised burr control in the Shire of Hay, the occurrence of the aquatic weed *Salvinia auriculata* along the coast, African lovegrass (*Eragrostis curvula*) in N.S.W., the noxious plant control activities of Local Government bodies in the Hunter Valley, and a suspected outbreak of Indian hemp (*Cannabis sativa*) at Windsor.

Individual Problem Weeds

Galvanised burr. — An officer commenced studies at the University of Sydney into the autecology of galvanised burr. This project is supported by funds provided by the Australian Wool Board.

Nodding thistle (*Carduus nutans*). — Another officer commenced research at the University of New England into the ecology and control of this plant. This project is supported by funds provided by the Australian Wheat Board.

Paterson's curse (*Echium lycopsis*). — A research officer of the Agricultural Research Institute conducted an initial survey of the occurrence of this plant in the Riverina.

African lovegrass. — The District Agronomist, Glen Innes, commenced a study of the ecology of this plant.

Weed grasses. — In crops, the weed grasses, wild oats (*Avena fatua*, *A. ludoviciana*), Wimmera ryegrass (*Lolium rigidum*), barley grass (*Hordeum* spp.) *Phalaris minor* and barnyard grasses (*Echinochloa* spp.) are being adequately controlled by herbicides and mechanical methods. The barnyard grasses are still the most important weeds of irrigated crops.

Broad-leaved weeds. — The broad-leaved weeds, thornapple (*Datura* spp.), Noogoora and Bathurst burrs (*Xanthium* spp.), skeleton weed (*Chondrilla juncea*), mintweed (*Salvia reflexa*), black bindweed (*Polygonum convolvulus*), spiny emex (*Emex australis*), fumitory (*Fumaria* spp.), soursob (*Oxalus pes-caprae*), silver leaf nightshade (*Solanum elaeagnifolium*), horehound (*Marrubium vulgare*), khaki weed (*Alternanthera repens*) and heliotropes (*Heliotropium* spp.) have continued to cause difficulties in many situations involving crops, roadsides and pastoral lands. In the past year the Darling peas (*Swamsona* spp.) have not caused severe stock losses.

During the favourable spring and summer seasons widespread outbreaks of St John's wort (*Hypericum perforatum*) and serrated tussock (*Nassella trichotoma*) occurred. It was impossible to prevent these weeds from seeding.

Woody weeds continued to cause concern in the Western Division because the cost of their control is beyond the individual landowner's resources.

Research — Weeds

Research continued into weed control in rice crops. Special attention was also given to the residual effects of alarazine used as a herbicide in grain sorghum crops grown in the rice rotation.

In the wild oats research programme at Tamworth Agricultural Research Station the competitive effect of wild oats on the wheat plant was studied in a glasshouse experiment. There was no interaction, suggesting that wild oats behaves as a physical replacement or as another wheat plant under the temperature and moisture conditions of the experiment.

Research was commenced at Tamworth on weed control in cotton and soybeans grown as irrigated row crops. The chemicals trifluralin and nitratin provided good grass control in both crops but failed to control broad-leaved weeds satisfactorily. *Datura ferox* (a thornapple) in soybeans was a particularly difficult weed to control.

In vegetable crops research yielded information on weed control in onions and beetroot and further work was begun on cucurbits, beans and tomatoes. Onions require long-term protection from weeds. Both propachlor and DCPA used as a pre-emergent application proved successful for this purpose, and mesoran, ioxynil or nitrofen offered a choice as post-emergent chemicals. In beetroot pyrazon and TCA were a safe combination for weed control.

The adaptive weed research programme on the use of herbicides on galvanised burr as a temporary control measure is near conclusion. The use of 80 per cent 2,4-D ester at 3 lb of active ingredient per acre plus 0.005 per cent distillate has been proved successful for boom spraying of infestations on treeless plains.

Research into the ecology of carpet grass has been commenced at Wollongbar Agricultural Research Station.

Registration of Herbicides

A number of formulations containing the new chemicals "improved" barban, karbutilate andalachlor, were registered as herbicides. Several industrial-type mixtures were recommended for registration.

DIVISION OF HORTICULTURE

GENERAL

STAFF

Administrative Professional Staff

Mr D. Leggo was appointed as Principal Fruit Officer (Research), Messrs. R. Sweedman, J. H. Duncan, J. A. Seberry and M. C. Stannard were appointed as Assistant Principal Fruit Officers Regulatory, Extension, Research and Citrus respectively.

Research Staff

There were three vacancies for Fruit Officers (Research) at the end of the year. One of these positions is to be retrenched because funds will no longer be available from the Banana Research Advisory Committee which has supported it. The remaining two vacancies are at the Horticultural Research Station, Dareton, and the Agricultural College and Research Station, Yanco.

One research officer, N. L. Wade, was awarded the degree of Doctor of Philosophy by the University of Sydney. Another officer completed course work towards his Master of Science degree and presented his thesis for examination. Mr R. E. Smart was awarded a scholarship by Auscott Pty Ltd, which will permit him to undertake studies in light use by vineyards at Cornell University, U.S.A.

The Assistant Principal Fruit Officer (Research) and two research officers attended a refresher course in plant physiology organised by the Australian Institute of Agricultural Science and held at Sydney University Farm, Camden. One research officer attended a Fortran computer programming course; another attended a special course on the techniques of immunoelectrophoresis, immunodiffusion and electrophoresis, for analytical work.

Extension Staff

At the end of the year the Division's extension establishment was at full strength, although one district officer had transferred to the Chief Secretary's Department and another resigned to accept employment in private industry. With the two vacancies which existed at the commencement of the year, these losses were numerically offset by the commencement on duty of four officers in training. However, because of the high complement of officers in training, four district positions were vacant at the end of the year: Griffith, Leeton, Barham and Lismore. Almost 60 per cent of the Division's extension staff have had less than five years' experience. This has caused problems because of the ever increasing demand for horticultural advice at a more advanced level, as well as difficulties in maintaining public relations and providing for the training and guidance of the young officers by experienced senior officers.

One District Fruit Officer, R. S. Sproule, completed the Hawkesbury Diploma in Rural Extension in 1970, whilst another is attending the 1971 course. Four officers are currently undertaking external University degree courses and three are attending the Irrigation Certificate Course at Yanco.

Regulatory Staff

The regulatory services of the Division are experiencing great difficulty in coping with the continuing increase in import-export trade which causes severe strain on existing resources. In particular the rapid increase in volume of plant quarantine work has required the use on occasions of markets staff for quarantine duties. Vacancies at the end of the year were for 10 inspectors (Plant Diseases Act) and 5 Regulatory assistants, compared with a total of 12 at the beginning of the year. The vacancies have resulted in some regulatory duties receiving less attention than is desirable. In addition a new position of Scientific Officer (Regulatory), created early in the year, has remained vacant. This position is the first of its kind in Australia. When filled, it will improve the technical efficiency of quarantine and export procedures.

The high proportion of vacancies and of inexperienced staff makes duty allocation a particular problem and places extra responsibility on the remainder of the staff. An in-service training course was conducted for 15 newly appointed staff, 6 inspectors attended the Public Service Board's Prosecuting Officers' Course, and 1 Supervising Inspector attended the Instructor's Course conducted by the Department of Customs in Canberra.

Overseas Visit

Mr J. F. Johnson, Principal Fruit Officer (Pome Fruits), visited New Zealand, U.S.A., Canada, England, The Netherlands, France and Italy during a three months' overseas study tour financed by the Commonwealth Extension Services Grant. The purpose of the tour was to acquire the most recent information in relation to pome fruit cultural methods, including rootstocks, tree training, planting density and mechanisation.

Regional Conferences

Regional conferences were held at Bathurst and Orange (deciduous tree fruits), Gosford (citrus and vine fruits) and Lismore (tropical fruits). Research, extension and regulatory officers working within the relevant fields met with senior officers of the Division at each of these conferences to discuss technological advancements and district problems.

FRUIT TREE CENSUS

The 1970 Fruit Tree Census was extended to include figures from the M.I.A. and north coast and consequently covered the entire state. The total area of fruit crops was 128,841 acres made up of stone fruit — 21,276; pome fruit — 21,982; citrus — 33,508; grapes — 28,057; berry fruits — 145; tropical fruits — 23,562; and miscellaneous — 311.

The Treasury and officers of this Department's Automatic Data Processing Section continued to provide assistance in processing the statistics.

RESEARCH FOR THE FRUIT INDUSTRIES

RESEARCH — POME FRUIT INDUSTRIES

Application of Growth Regulators

Effect of alar on fruit quality. — Preliminary investigations at the Bathurst Agricultural Research Station with the growth regulator alar (succinic acid 2,2-dimethyl hydrazide (SADH)) in 1970 showed that a 1,000 ppm spray applied to apples between 45 and 60 days prior to harvest increased fruit colour and fruit firmness, prevented the occurrence of Jonathan spot and provided some control of pre-harvest drop. All these effects were considered to be of commercial significance, especially the ability of SADH to increase fruit firmness (or delay maturity), since this could provide the means to lengthen the optimum harvesting season for certain apple varieties, a factor of some importance for heavily planted varieties with a short harvesting season such as Delicious.

The work was repeated in 1971, when it was possible to treat the same Delicious trees as in 1970, but the Jonathan trees were different. Fruit colour of Delicious was not improved as it was in 1970. Jonathan colour, as in 1970, was not appreciably increased. Maturity of Delicious was again delayed but perhaps less noticeably than in 1970. The delay in Jonathan maturity was more marked than in 1970 and (unsprayed) controls could be easily noticed by their yellow base colour. Generally, the sprays reduced fruit drop in both varieties in both seasons. Neither water core nor scald developed in treated or untreated fruit stored from the 1970 harvest and thus overseas reports that SADH reduces the incidence of these disorders could not be confirmed. After five months' storage, the difference in ripeness between sprayed and non-sprayed Delicious could not be seen easily, but Jonathans sprayed with SADH remained firmer and developed very little Jonathan spot compared with the controls.

However, all Delicious fruit from trees sprayed in the two successive seasons were flattened with a shallower calyx basin surrounded by more prominent bosses. It was difficult to pack this fruit satisfactorily in tray pack cartons. The fruit shape was commercially less acceptable than fruit from untreated trees or fruit from trees sprayed for one season only.

Increasing fruit set of pears with 2,4,5-TP. — Following the failure of autumn sprays of 2,4,5-TP to affect fruit set in trials carried out in previous seasons, sprays of 5 and 10 ppm were applied to Packhams Triumph and Williams Bon Chretien trees at 50 per cent full bloom in 1970. Fruit set was not increased with Williams, but with Packhams Triumph set was increased from 15 per cent to 24 per cent on trees treated with 5 ppm 2,4,5-TP and to 27 per cent with 10 ppm. At harvest, fruit number was increased, especially with the 5 ppm spray, but the increase was not reflected in total crop weight — the increased number of fruit on the treated trees did not size to the same extent as the fruit on control trees. In addition, fruit shape was adversely affected. Treated fruit was shorter with a flattened calyx end and the calyx was set in a large deep basin. Further investigations, in which timing of application will be more closely studied, are in progress.

Widening branch angles of young apple trees. — Several growth substances are being investigated as agents for widening branch angles of young apple trees. If successful, the results will be quite important as limbs with wider branch angles are stronger in structure. Additionally, the development of trees with wider branch angles will be of advantage for current tree training methods.

The growth substance TIBA has been investigated at the Bathurst Station and in the Batlow district for two seasons. Whilst some positive effect has been recorded, it is doubtful if the tree response has been sufficient to warrant continuation of trials with this chemical. However the effect of two further growth substances, benzyladenine and GA₄₊₇ used in combination, is being examined in trials at Bathurst. It appears that branch angles are wider and shoot growth better in the treated trees.

Apple Tree Training

The final planting will be made in winter 1971 to complete a tree training-rootstock-variety trial at the Orange Agricultural Research Station. The completed planting, comprising 1,000 trees, will compare four tree training systems for three varieties each worked onto four different rootstocks. Economic aspects of all treatments and cultural practices are being studied. The cost of establishment of the Palmette system has been much higher, an additional \$600 per acre, than for other tree forms.

The trial is of considerable interest as two of the rootstocks are semi-dwarfing types of importance overseas, whilst three of the training systems have been successfully used in overseas plantings. Two of the training systems have not previously been evaluated in N.S.W., whilst the other two have not been evaluated in association with semi-dwarfing rootstocks.

Planting Distance for Apples

A trial incorporating the Granny Smith, Delicious and Jonathan varieties was established in 1967 at the Orange Station to examine the effect of planting distance on tree growth and productivity. Trees were planted within the row at distances ranging from 6 feet 6 inches to 13 feet apart, in 6 inch increments. The first commercial crop was produced in autumn 1971. Although the closer planted trees on NS6, MM106 and MM104 rootstocks are growing together, the individual tree data on crop weights and size, number and colour of fruits do not indicate any differences due to spacing at this stage.

Short-Term Apple Storage at Ambient Temperatures

Studies of the short-term storage of Granny Smith apples under controlled atmosphere (CA) conditions but at ambient temperatures were commenced in 1970. The trials, aimed at the development of an inexpensive method for short-term storage of apples for the winter market, have been at ambient temperatures at the Bathurst Station and at 50°F constant temperature at the Ryde laboratories.

Rotting, yellowing and shrivelling of fruit were reduced by the CA treatment but core flush was a serious disorder late in storage (3–4 months) (the season was one in which core flush was common in Granny Smith apples). A Canadian report that reduction of ethylene concentration reduces core flush is being checked. Ethylene is very difficult to remove from apple CA stores, but recent work has shown that ultraviolet rays are capable of destroying appreciable amounts of ethylene. With this objective, an ethylene scrubber has been designed and will be tested with apples.

Herbicide Trials

The long-term effect of annual applications of four commonly-used chemical herbicides is being studied at Bathurst Agricultural Research Station. Herbicides are being used at normal, approximately twice and four times normal application rates with mature apple trees and at normal, approximately twice and three times normal rates with younger trees. In the mature trees the only damage caused was associated with the use of diuron. Injury was severe in the previous season on those trees receiving the highest rate of diuron (four times that recommended). The application was withheld from the trees this season, but the injury symptoms again developed quite seriously. However, trees which have received normal (recommended) dosage rates for six years have shown no signs of damage. In the young tree trial, only diuron at three times the recommended rate caused injury this season. No damage has occurred with any of the four herbicides when used at recommended rates since the trial began in 1966. An increased growth response was achieved with applications of simazine and diuron.

After the second season a pilot trial at Bathurst indicated that the recently introduced herbicide, terbacil, at rates up to 4 lb per sprayed acre, is both effective and safe to use around mature apple trees. Severe damage was caused by terbacil at 4 lb per acre applied around mature Josephine pears. Very slight injury occurred at a 2 lb rate.

Fertilisers in Planting Hole – Apples

At Bathurst, the effects on tree health and growth of incorporating commercial fertilisers in soil within the hole at planting are being examined. None of the fertiliser treatments has markedly increased growth compared with untreated controls. Two commercial mixtures at dosage rates of $\frac{1}{4}$ lb, and superphosphate at 2 lb increased growth slightly. Several trees which received higher dosage rates of mixed fertiliser are very sick. Treatments which include a high percentage of nitrogen have caused most tree injury whether directly as shoot die-back or indirectly as severe bark necrosis. The only trees without bark necrosis are the controls and one receiving superphosphate. Whilst further growth measurements have yet to be made, it does appear at this stage that there is risk involved where any one of a number of fertilisers are placed in planting holes.

Semi-Dwarfing Quince Rootstocks for Pears

The need to find a satisfactory semi-dwarfing rootstock for pears is important as the currently recommended *calleryana* D6 rootstock produces a tree too large and too late in maturity for industry requirements. Continued observations at Bathurst during the year have now clearly shown that no important commercial pear variety grown in N.S.W. can be successfully established directly onto the Forbes strain of quince rootstock. Observations in previous years suggested that at least the Winter Cole variety would be compatible but this year several trees have snapped off at the union.

However, in a complementary trial, Winter Cole and Williams established very satisfactorily where an intermediate stem piece of Beurre Hardy has been used between the rootstock and scion. Trees of Josephine, Packhams Triumph and Beurre Bosc, similarly propagated, are not growing satisfactorily, although the reason may be poor soil conditions. To put this beyond doubt a small trial is to be planted on good horticultural land at Orange in which four pear varieties worked onto two quince strains, all with an intermediate stem piece of Beurre Hardy, will be observed.

Spraying for Two-Spotted Mite Control

Two-spotted mite, which can have an adverse effect on tree health and fruit quality, is the most difficult pest to control in pome fruits. Effective chemicals are available. The problem has appeared to be in applying them. Hand spraying is effective but is now a very unpopular method with growers. But growers have often had difficulty in achieving satisfactory control with automatic spray equipment.

The problem was examined by officers of the Divisions of Horticulture and Research Stations and officers of the Biological and Chemical Research Institute in a trial in a commercial orchard at Orange. They compared automatic spray machines with thorough hand spraying. Mite populations were extremely high, particularly in the upper portions of the trees, at the start of the trial, averaging up to 100 or more per leaf. Two automatic machines gave excellent results, at least comparable with thorough hand spraying and as good as could possibly be expected. The results from the other two automatic machines were equal to or better than the average control being attained commercially but were well below the ideal being sought.

The conclusion was that excellent control of two-spotted mite can be obtained with automatic machines where they are set up and operated correctly. Growers' problems in control can be resolved by advising them that at least a number of commercial spray units available are capable of providing excellent control of two-spotted mite if used in accordance with manufacturers' directions.

Spray Damage to Delicious Apples

A severe fruit russet damage to an estimated 55,000 bushels of Delicious apples in the Orange district was investigated during January to March, 1971. The damage was allegedly caused by a chemical spray applied in the spring of 1970. An investigating team of officers of the Division of Horticulture and the Biological and Chemical Research Institute inspected 67 orchards and processed 118 questionnaires returned by growers. It is considered that very low temperatures in October–November, 1970, were an important factor in the occurrence of the damage.

RESEARCH – CITRUS INDUSTRIES

Zinc Deficiency Sprays and Regreening of Valencias

Recent research at Dareton Horticultural Research Station has shown that annual foliar sprays of zinc to maintain adequate zinc levels increase the severity of regreening with Valencia oranges. Regreening occurred regardless of the compound used, although zinc sulphate showed less of the effect than zinc oxide, and autumn applications less than spring. Zinc is the most common trace element deficiency encountered in the inland citrus districts. In the past, annual spray applications of zinc sulphate plus lime were used during spring, while more recently, zinc oxide has been preferred

by some citrus growers. However, it has now been shown that lime is not necessary in zinc sulphate sprays so unsightly deposits which occur when lime is included need no longer be a problem. Additionally a lower rate of zinc sulphate was found to be adequate to correct deficiencies while not accentuating the regreening problem.

Biennial Bearing Control of Valencia Oranges

Large variations in Valencia orange cropping from year to year make it difficult to arrange assured export markets and supplies to processors. The alternate bearing problem has been studied world wide, but an acceptable method of control for general commercial use has not yet been found. Trials have been started at Dareton and Yanco Stations to investigate the effects of gibberellic acid sprays on flower initiation and the subsequent control of fruit set in potentially on-crop years. The projects are being conducted in co-operation with CSIRO, Division of Irrigation Research, where the idea was conceived following pilot trials. The pilot trials suggested that applying gibberellic acid during floral initiation, in a season when a heavy blossom is expected, would reduce the number of flowers and subsequent fruit set. Precise timing of the spray is not thought to be critical. This approach would be highly acceptable commercially if successful.

Rootstocks

Phytophthora resistant rootstocks named. — A number of rootstocks bred by the Department and selected for *Phytophthora* resistance were incorporated in a trial with several scion varieties at Yanco in 1965 to evaluate compatibility of the various combinations. A number of definite scion-rootstocks incompatibilities soon became apparent with Lambert Eureka lemon. However the performance of two citrange rootstocks bred by Dr F. T. Bowman, a former Chief of the Division of Horticulture, was encouraging. They have been named Bowman and Benton (the latter after the late Mr R. J. Benton, former Citrus Specialist and later Principal Fruit Officer (Extension)). The two selections have shown promise as rootstocks for navels, Valencias and mandarins, as well as for the Lambert Eureka lemon, a variety generally regarded as incompatible with *P. trifoliata* and its hybrid citranges.

Lemon rootstocks. — *Citrus macrophylla* has been investigated as a rootstock for Lambert Eureka lemon at the Narara, Yanco and Dareton Research Stations. Impressive under Californian conditions, its performance in N.S.W. has been most variable. While lemons propagated on *C. macrophylla* are very dwarfed at Narara (Somersby section), they have grown progressively better at Yanco and Dareton, and could have commercial possibilities in Murray River districts. Compared with rough lemon rootstock, *C. macrophylla* has, in each locality, been less vigorous, but the difference in vigour and cropping has been least at Dareton where its prospects could be promising if planting distances were modified to compensate for smaller tree size.

Nutrition

A factorial nutrition trial planted at the Dareton Station in 1968 compares 64 nitrogen, phosphorus and potassium combinations on Valencia orange growing on Troyer citrange and sweet orange rootstocks in each of two soil management programmes. The differential fertiliser treatments were commenced in 1970 when nitrogen was applied as three split dressings, potassium as one dressing, and phosphorus by deep placement of superphosphate in four auger holes at the periphery of the root zone.

Deep placement of superphosphate is being tested because it is likely to be fixed in the first few inches when applied to the soil surface. Surface placement is especially questionable where a bare soil surface is maintained with herbicides, as is now common. Deep placement of superphosphate in trenches may be a practical method for users of herbicides, especially if it needs to be done only ever few years. A pilot trial comparing a three year supply by trench, three year supply by surface application, and yearly surface treatments has been laid out on the buffer rows of the main trial. No response to deep placement was apparent after several months but the next annual foliar nutrient analysis should provide positive indications. District interest in phosphorus placement has prompted similar trial work on growers' properties.

Pre-Harvest Drop Control

Trials commenced in 1965, with progressive changes in rates, timing and chemicals, showed that MCPA was not as effective in pre-harvest drop control as commercial formulations of 2,4-D amine salt. Similarly, the ethyl ester of 2,4-D was unsatisfactory, although the iso-propyl ester produced good results in some seasons. 2,4-D amine salt applied at 20 ppm in mid-May was generally the most satisfactory for navels and grapefruit. Repeat sprays later in the season had a further steadying effect on drop rate, but it is doubtful whether these, or split applications at half strength, are economic. The use of gibberellic acid in conjunction with 2,4-D for maintenance of external quality in late hanging grapefruit is now being studied.

Green Mould

Fungicide screening. — A new fungicide, thiophanate-methyl (NF 44), developed by a Japanese company, has shown promise for control of green mould (*Penicillium digitatum*) of citrus in several trials at the Citrus Wastage Research Laboratory, Gosford. It has compared favourably with thiabendazole (TBZ) and benomyl, two fungicides which have already been extensively examined and shown to be outstanding for control of green mould. As with TBZ and benomyl, NF 44, which is also a water wettable powder, has maintained effectiveness against mould for up to five months after initial preparation of suspensions.

Commercial application of thiabendazole(TBZ). — Recommendations for the use of TBZ on citrus fruits have been published by the Citrus Wastage Research Laboratory, Gosford, and circulated through state departments of Agriculture to extension officers and citrus packing houses throughout Australia. They are based on commercial trials at Gosford and Griffith and commercial experience in packing houses in South Australia. The recommendations are for a flood treatment of fruit with 1,000 ppm TBZ (not rinsed), after washing and before waxing, as an alternative fungicide treatment to the SOPP dip-rinse treatment for control of fungal wastage after harvest. Instructions are included for maintaining the concentration of applied TBZ above a minimum level of 800 ppm during operation. Trials had indicated typical stripping rates under commercial conditions.

Lemon storage. — A storage trial with lemons was conducted at the North Ryde and Gosford laboratories from June to December, 1970. Benomyl was an extremely effective fungicide for controlling rots, principally green mould and stem-end rot (*Diaporthe citri*), particularly over long periods. It proved superior to TBZ which lost its effectiveness after three months' storage.

Rind Blemish

Wind scarring. — Citrus rind blemish investigations at Gosford confirmed that 90 to 95 per cent of all fruits studied were blemished by wind within the 12 week period from petal fall. It has been determined that fruitlets abraded by leaves release small quantities of oil and from this initial wounding a blemish appears due to the development of corky tissue. These early blemishes are smooth and superficial at harvest as much of the corky tissue erodes as the season progresses. Although only a small percentage of the total, blemishes initiated after December are generally more severe and retain their corky or "scabby" nature until harvest.

Cuticular wax studies. Cuticular wax development could affect the nature and extent of blemishes of citrus rind. Quantitative comparisons of inland and coastal fruit samples are indicating interesting trends which vary between districts. For Somersby fruit wax values were initially high at 50–60 mg/cm², but decreased to a level of 20–25 mg/cm² on fruitlets harvested about 60 days after petal fall, and subsequently remained relatively constant. Samples from Dareton and Yanco however, showed a dramatic increase from less than 20 mg/cm² to more than 100 mg/cm² about 100 days after petal fall. Electron microscopy has revealed that surface waxes are in the form of flattened platelets, variable in size and distribution. This is a new field of citrus research.

Rootstock-Scion Incompatibility

The breaks in cambial and vascular continuity at the bud union associated with the "yellow ring" condition with Eureka lemon on trifoliata and its hybrids were examined in microscopic studies of citrus rootstock-scion incompatibility at the Horticultural Research Station, Narara. The site and sequence in development of the condition were traced. A bark ring grafting technique has provided another promising method for early assessment of rootstock-scion incompatibility. The aim of these studies is to develop a means of predicting incompatibility between citrus rootstocks and scions. This would allow for more rapid utilisation of hybrid rootstocks from breeding programmes and allow the assessment of a greater range of material.

RESEARCH — TROPICAL FRUIT INDUSTRIES

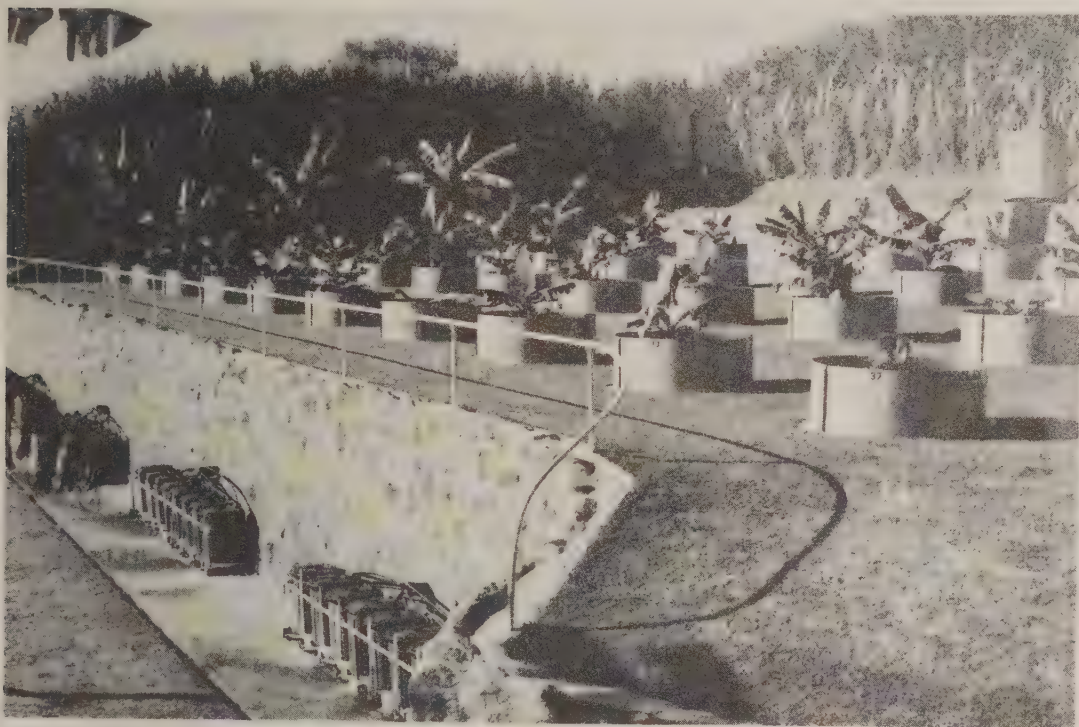
Banana Nutrition

Sand culture pot trial. — The experiment at the Tropical Fruit Research Station, Alstonville, to observe the effects of deficient levels of K and Mg on banana plant growth, yield and leaf nutrient composition at normal and toxic levels of Mn supply is continuing. Deficiency of both K and Mg reduced growth, the sucker (first ratoon) being more affected than the plant crop. Toxic levels of Mn reduced the growth of the plant crop after the sucker began to grow. Increasing the supply of K increased levels of K, P and Mn in the leaves and depressed Mg levels. Mg applications increased leaf Mg levels, while toxic Mn supplies increased leaf Mn and decreased leaf K. The trial is emphasising the importance of K in banana nutrition and the effects of high Mn on leaf concentrations of K. Visual symptoms of nutrient deficiencies are becoming apparent in some treatments.

The completion of the installation of an automatic watering and drainage sampling system will facilitate management of the experiment.

District trial. — A short-term trial has been commenced at Dunoon on the response of bananas to N,P,K and Mg fertilisers on a red krasnozem soil of low fertility.

Decline of nutrient reserves in spent pseudostems. — Using ratoon crops, studies on the decrease in organic and mineral reserves in cut banana pseudostems were commenced. Levels of some nutrients, including N and P, fell as time after harvest increased.



Nutrition of banana plants is being studied in sand culture at Alstonville Tropical Fruit Research Station. Results have emphasised the importance of potassium.

Banana Post-Harvest Studies

Projects conducted on behalf of the Banana Research Advisory Committee were continued at the Tropical Fruit Research Station.

Green-life studies. — Four major experiments, two with summer fruit and two with winter fruit, to examine the relation between time from bunch emergence to harvest and subsequent green-life have been completed. The results indicated the practical importance of tagging bunches according to their time of emergence as an aid in deciding when to cut. Commercial maturity was reached by summer fruit in about half the time taken by winter fruit — an average of 120 days as against 235 days. The use of heat units as a measure of maturity did not appear to offer promise under the sub-tropical conditions that exist at Alstonville.

Transport trials with packages. — Several trials have demonstrated the superiority of the fibreboard carton over the wooden box and of polyethylene liners and bags over paper in protecting fruit against injuries during transport.

Control of market diseases. — The effectiveness of benomyl as a post-harvest dip treatment for bananas has been investigated in trials in several growers' packing sheds. It has been demonstrated that benomyl is more effective than TBZ for control of black end, crown rot and squirter. Both fungicides have been approved by Australian health authorities and registered in N.S.W. for post-harvest application to bananas. In preliminary trials, an experimental fungicide, thiophanate-methyl (NF 44), has also shown promise for control of black end of bananas.

Controlled atmosphere storage. — In preliminary experiments over the winter, bunches of bananas at Alstonville were sealed in polyethylene bags about four months after emergence. Modified atmospheres developed in the bags, and fruit from bunches harvested about three months after the bags were sealed was found to take longer to ripen than fruit from unsealed covers. When fruit left in the plantation in unsealed covers became ripe, fruit in sealed bags was still hard and green. The latter was then harvested and ripening occurred after a further 20 to 31 days. However, under summer conditions, ethylene levels in the sealed bunch covers rose to 1–2 ppm and the fruit eventually became “green-ripe”. It has been shown that the polyethylene covers produce ethylene in the presence of light and the use of other materials is being investigated.

The occurrence of the “green ripe” disorder, in which the pulp of a banana may ripen whilst the peel is still green, has been studied in bananas stored in sealed polyethylene bags at North Ryde. At concentrations of oxygen greater than 5 per cent, ripening induced by applied ethylene of both peel and pulp tissue developed in phase, and resembled ripening in air. The “green ripe” condition was induced when fruit was exposed to ethylene in the presence of 2 to 4 per cent oxygen. Although pulp ripening was delayed relative to ripening in air, initiation of chlorophyll breakdown in the peel was delayed still longer.

Avocados

Data are being collected in co-operation with the Chemistry Branch on fruit development, oil content, time of harvest and field factors relating to maturity to determine a reliable maturity index for avocados under N.S.W. conditions.

A trial to examine the effect on yield of avocados of limb cincturing (girdling) was commenced at Alstonville.

Macadamias

A trial to compare various rates of trickle irrigation for the establishment of macadamias was laid out on a block of trees planted in 1969 at Dunoon. Supplementary water is being applied on three days per week when the rainfall for the previous two days is less than 36 points in summer, 27 points in spring or autumn, and 18 points in winter.

RESEARCH – GRAPE INDUSTRIES

Pruning, Training and Spacing of Wine Grapes

Trials on pruning, training and spacing of wine grape varieties were continued at Griffith Viticultural Research Station.

Shiraz. — Four different pruning methods and two trellising methods are being compared on Shiraz vines planted in 1962. Generally, vines trained on a 15 inch wide “T” trellis have outyielded those trained on a single wire trellis by 10 per cent but there has been little difference in yield between vines pruned to the four different pruning methods.

Semillon. — Vines planted in 1962 and trained on a 15 inch wide “T” trellis conclusively outyielded vines trained on a single wire trellis. Spur pruned vines outyielded vines pruned to canes in the long-term after yielding less in the first three crop years. The trial was terminated and new treatments, studying the effect of four widths of trellis and four levels of severity of spur pruning, were commenced on the experimental vines in 1970. The first crop from these new treatments is expected in 1972.

Muscat Gordo Blanco. — Vines planted in 1962 four feet apart in the rows had substantially greater yield per acre than vines planted seven feet apart. There was no difference between treatments comparing four levels of pruning severity or between the standard single wire trellis and the narrow “T” trellis. In 1970–71 fruit was removed from all vines to encourage more vigorous vegetative growth so that vines, particularly those in the seven feet spacing treatment, may completely fill the vine trellis. This will test the hypothesis that the difference in yield between vines planted seven feet and four feet apart in the rows is associated with the more complete use of trellis by the latter.

Sultana pruning and wrapping. — A trial was started in 1969 at the Horticultural Research Station, Dareton, to study the direction of wrapping sultana canes and the need to leave spurs for replacement canes. The second crop was harvested in 1971. Highest yields were obtained from vines pruned and wrapped by the conventional method.

Fruit Setting and Berry Sizing

Currant. — The effects of gibberellic acid (GA), PCPA, CCC and cincturing on berry set and sizing were studied at Dareton. Cincturing gave the greatest yield of dried fruit, followed by sprays of 20 ppm of PCPA applied at the match-head stage. The main effect of the treatment was to increase average berry weight rather than fruit set.

Sultana. — Contrary to the lack of response obtained with sprays of GA and PCPA on vines at Dareton in 1969–70, a light crop was responsible for an excellent response in 1970–71. Sprays of 50 ppm GA applied at shatter, and 10 ppm GA at shatter plus 20 ppm PCPA applied one week later, increased berry size by 50 per cent. The effect was similar on vines which have been treated with GA since 1966 and vines treated with GA since 1969. Because of the light crop, bunch trimming had little effect on berry size.

Waltham Cross. — The effects of full bloom and shatter sprays of 10 and 20 ppm of GA on fruit quality and production were studied at Griffith. All sprays reduced the proportion of seeded berries and sprays applied at cap fall reduced average berry size. Despite the increase in seedless berries, sprays of GA applied at shatter appeared to increase average berry size and reduced the incidence of "hen and chicken".

Black Muscat. — At Campbelltown studies continued on reducing bunch compactness and improving fruit quality with sprays of gibberellic acid. GA applied at concentrations of 5 and 10 ppm at the end of bloom caused excessive berry thinning of the bunches, while sprays applied at the end of shatter had little effect on bunch loosening.

Clonal Selection

Shiraz. — Selections made during 1968–69 from the Hunter Valley and the MIA and planted out in a 9 x 9 triple lattice design assessment trial at the Griffith Station were trellised during 1970–71. A three feet wide "T" was used. A small crop is expected in vintage 1972, but the first crop of significance in clonal assessment is not expected until vintage 1973. Pending completion of testing of these selections, three of the top yielding clones in a pruning trial at the Station are being multiplied as an interim source of clonal material, and approximately 20 acres were planted with this material on commercial vineyards at Griffith. These vineyards should supply sufficient cuttings for 200 acres of commercial plantings for the 1972 planting season.

Semillon. — Selections made during 1968–69 from the Hunter Valley and planted at Griffith Station in an 8 x 8 triple lattice design assessment trial together with unselected clones were trellised to a three feet wide "T". No interim propagation of promising clones has been undertaken for this variety partly because of a declining call for Semillon and partly because of the availability of cuttings from a block of leaf roll-free Semillon at Griffith.

Cabernet Sauvignon. — A 8 x 8 triple lattice design assessment trial was planted at the Griffith Station in 1970. It includes vines selected from the MIA source planting of this variety, on 1970 yields and comparative freedom from leaf roll, as well as outstanding vines from Forbes, Coonawarra, and the South Australian Department of Agriculture. This material was also propagated for planting in a five-acre block at Griffith to provide an interim source of cuttings for commercial growers. The planting should produce sufficient cuttings for 50 acres of plantings in 1971.

Pinot Noir. — Propagation and distribution of the Hunter Valley selection MV 6 continued.

Grenache. — In co-operation with the Victorian Department of Agriculture, blocks of Grenache in the Sunraysia area were examined in autumn, 1970, for freedom from leaf roll. Two blocks at Pomona were found to be relatively free and cuttings were made available to nurserymen. In addition cuttings from outstanding vines will be collected for propagation and testing at the Dareton Station.

Currants. — Clones selected during the last two years, including one outstanding mutant, will be planted in an assessment trial at Dareton. These clones will also be planted on a commercial block to act as an interim source of propagating material until the assessment trial is complete. Clones selected by the Victorian Department of Agriculture will be included in the assessment trial to compare the relative merits of Victorian and N.S.W. selections.

Muscat Gordo Blanco. — The top selections of 49 clones being assessed at Dareton will be planted on a district block in 1971 to provide a source of cuttings as well as a more thorough assessment of the relative merits of each clone. Additionally, an extremely vigorous and heavy setting clone has been located in the Griffith district and this will be propagated and assessed in 1971. The clone offers particular potential for the table grape market.

Purple Comichon. — Selection for leaf roll-free clones has commenced with the prime purpose of improving fruit quality.

Black Muscat. — It is very probable that the uneven ripening often experienced with this variety is related to virus infection (leaf roll) and selection of promising clones will be commenced in 1971.

Vine Slashing

A vine slashing trial on Shiraz at Griffith was continued for the second year. The effect of slashing vine shoots at five different times during the growing season back to two or six nodes above the first bunch is being assessed. Yields of slashed vines were generally comparable with unslashed vines. Berry size was reduced by slashing during the berry set period and sugar content was reduced by slashing during veraison. These slashing treatments were extreme. The results confirm the conclusion of last season that slashing or tipping as practised in commercial vineyards causes little damage.

Light Use by Vineyards

Interception. Mathematical functions for the definition of insolation of regular vine planting arrangements have been formulated. The effects of varying row spacing, vine height and width, inclination of vine sides, row orientation, latitude, cloudiness and trellising on insolation have been taken into account in the formula. It has been calculated that normal irrigated vines intercept about 60 per cent of available light and that north-south rows intercept more light than east-west rows. Analysis reveals that the Geneva Double Curtain (GDC) system of trellising does not intercept significantly more light than standard single wire trellises and that the greater production from GDC trellises can be attributed to better utilization of intercepted light.

Utilization. — Further studies of the quantitative assessment of light assimilation rates of vine canopies confirmed that use of light in the canopy of vines trained to a bilateral cordon is quite inefficient. Most light is absorbed by the exterior layer of leaves at saturating flux densities leaving very low flux densities of diffuse light for leaves inside the vine canopy. Measurements have indicated that the internal leaves of a canopy are not photosynthetically independent and record a net loss of carbon.

Vine Variety Collections

At the Griffith Viticultural Research Station 160 vine varieties, including overseas and interstate introductions, are now established in two-vine plots. Fourteen white wine and five red wine varieties have been established in 32-vine plots for further assessment of their commercial qualities and to provide a moderate sized source of cuttings for grower use. At Dareton, a collection of some 70 varieties of wine, drying and table grapes has been established.

RESEARCH — STONE FRUIT INDUSTRIES

Variety Introduction, Selection and Assessment

Canning fruits. — Hail damage in peach variety trials at Yanco limited the amount of fresh fruit data collected, but where possible samples were collected and canned from all promising selections. Data will be collated for examination at a canning peach conference in November, 1971, when it should be possible to select varieties for observation in district plantings before deciding on commercial recommendations.

Field performance and canning quality of 16 apricot selections planted in 1962 are still being recorded. Data are required from one or two more crops before promising clones can be selected, but so far Trevatt, the standard commercial variety grown in the district, appears superior when both yield and canning quality are taken into account.

An additional canning peach variety, Walgent, and three apricot varieties, Peeko, Bulida and Royal B, recently introduced from South Africa, are still held in quarantine. They will be planted in variety trials at Yanco when released.

Dessert peaches. — Comparison of recent introductions and locally selected seedlings in peach variety trials at Bathurst and Narara Stations, and district demonstration plots has provided a reliable guide to variety recommendations. Four recent introductions (Maygold, Starking Delicious, Coronet and Redhaven) and two local selections (Fragar and Glenalton) are now being extensively planted to supplement the mid-season and late-maturing, yellow-fleshed varieties, Halehaven, Blackburn and J. H. Hale. An unnamed selection from the Bathurst Station has produced heavy crops of excellent quality and is to be released. Some additional introductions from the U.S.A. are in quarantine awaiting release.

Nectarines. — The recently introduced Nectared series of yellow-fleshed nectarines cropped for the first time in trials at Bathurst and at Hawkesbury Agricultural College and a few fruits were produced on trees in district plots. Fruit from a number of the strains was very highly coloured and attractive in appearance. Favourable prices were received in city markets for consignments of fruit from Bathurst and agents expressed the opinion there would be a steady demand for yellow-fleshed nectarines. The Department is cautious about recommending the varieties until they have been more fully tested under a wide range of conditions. Trial plantings have been established in all major producing areas for this purpose. Additional yellow-fleshed varieties, more highly regarded in the U.S.A. than the Nectareds, have now been introduced and are being held in quarantine for virus indexing. These varieties include Le Grand, Independence, Flavertop and Fantasia.

Plums. — A large collection of plum varieties has been established at Bathurst for re-assessment of the potential value of all varieties known to be available in Australia. Selections have been planted in a district trial plot at Werombi near Camden. An increased demand for plums has followed improved market presentation resulting from the development of more suitable packages and there is renewed interest in a number of varieties that were previously unacceptable because of poor carriage.

Prunes. — The quality of fruit samples of two strains of d'Agen prunes, one early and one late maturing, which could be used commercially to extend the harvesting season was considered to be satisfactory by a testing panel who compared them with the standard d'Agen. Existing plantings of the earlier maturing strain have provided sufficient information on its field performance to recommend limited plantings. The late maturing strain was only selected last year, and trees are being propagated for field testing on a larger scale.

Cherries. — In district plots the cherry varieties Regina (bred by the Department) and Merton Heart (an introduction) have done well at Young while Ransom and Regent (both bred by the Department) show promise at Orange. A cherry variety collection was established on the Agricultural Research Station, Orange. It includes the introduced varieties Sam, Deacon, Lambert and Van which have not yet been tested in orchard plantings in N.S.W.

Clonal strain selections. — Selection of trees with outstanding performance as budwood sources for fruit tree propagations continued. Trials were established to compare five strains of the main dessert variety, J. H. Hale; nine strains of the main canning peach variety, Golden Queen; three early Queen selections; and three late Queen selections. Trees were propagated for a further trial to compare eight d'Agen prune strains. Strains of varieties of lesser importance were selected and planted in arboretum blocks for observation.

Strawberries. — The strawberry breeding programme continued at Narara. A number of selections that showed early promise were found to be highly susceptible to the fungal disease, leaf scorch (*Diplocarpon earliana*). Some of the most susceptible were discarded. Others are being held pending trials by the Biological and Chemical Research Institute on control of the disease by fungicides.

Nuts and miscellaneous fruits. — Variety collections of walnuts, pecan nuts, almonds, filberts, pistachio nuts, olives, persimmons and figs were maintained in research station orchards.

Rootstocks

Peach trees on plum rootstock strains introduced from England some years ago have been less vigorous than those on peach seedlings in a trial at Bathurst Research Station. Suckering has been a serious problem. New trials to compare commonly used peach seedling stocks with seedlings of two introduced nematode resistant varieties have been established on new land at Bathurst and as a replanting at Yanco.

Apricot seedlings and Buck plum are being compared as rootstocks for apricots in an irrigated trial planted at Yanco Research Station in 1968. Trees on Buck plum have grown more vigorously. Cropping and fruit quality evaluations will be possible over the next few seasons.

Plum rootstock strains from East Malling, England, are under test as rootstocks for prunes in trials recently planted at Yanco and Young. The influence of various intermediate stem piece selections on the performance of d'Agen prunes on Buck plum is being studied at Yanco.

Trials in the Orange district have demonstrated a partial resistance of F12/1 and Deister cherry seedling rootstocks to bacterial canker infection. A virus-free clonal selection of F12/1 is now being increased in the Department's nurseries and Mahaleb seed from virus-free material is being produced at Bathurst and Glen Innes to provide more reliable rootstocks. Field plots have been established at Orange and Lakesland to demonstrate the reduction of tree losses by high working stocks after they have been well established in orchard plantings.

Nutritional Studies

The Division and the Chemistry Branch have co-operated in the collection and chemical analysis of leaf samples from stone fruit plantings in the main producing centres of the state. Leaf analysis of peaches in the Murrumbidgee Irrigation areas over a number of years have now provided reliable reference information on leaf nutrient levels in blocks producing satisfactory yields and have thus helped to establish a basis for general fertiliser recommendations. During the past season leaf analyses studies were conducted in selected reference orchards in coastal, tableland and inland districts and were extended to include apricots, plums, prunes and cherries.

Deciduous Fruit Tree Improvement

Continued inspection of selected parent tree plantings used by nurserymen as a source of budwood has assured less risk of virus in trees produced for commercial plantings. Virus-free propagation material of the canning peach varieties Golden Queen, Halford, Levis and Pullar, obtained from Victoria, is being multiplied as rapidly as possible and supplies of budwood should be available to nurserymen within two years. Although Golden Queen is the only one of these varieties being grown to any extent in N.S.W., budwood supplies of the others will be available if required. Other virus-free varieties will be obtained as they become available.

The Division is co-operating with the Biology Branch in investigations of virus problems such as the peach rosette and bud-shedding conditions, which have been detected in the MIA, and apricot decline in the Kurrajong area.

Mechanical Harvesting

Tree training. — Cropping behaviour of canning peaches with various tree forms expected to be adaptable to mechanical harvesting, is being compared at Yanco. Pilot tree training trials with prunes, similar to those at Yanco, have been established at Young and Griffith. The need for butt shading of high headed trees is receiving attention.

Mechanical harvesting of prunes. — A mechanical harvester for prunes, purchased with Commonwealth Extension Services Grant funds, was received at Yanco just prior to the 1970–71 harvest. Some pilot runs were possible. Trials will start in the 1971–72 season in co-operation with the Agricultural Engineering Section.

High Density Plantings

Pilot trials were established at Bathurst and Yanco with dessert and canning peaches respectively to examine training methods suitable for intensive planting. Study of modified pruning methods and trellising and espalier systems, is necessary because close planting of peaches in Australia with conventional pruning has been unsuccessful.

Fruit Thinning and Fruit Growth

Fruit thinning and fruit growth trials at Yanco, included study of the interaction between two levels of applied nitrogen and four levels of cropping on yields of canning size fruit. The higher rate of nitrogen application (2 lb N per tree) appeared to increase fruit size on the more heavily cropped trees.

In other trials results were inconclusive with two chemical thinning materials both in relation to thinning and subsequent size development of fruit. In a comparison of blossom thinning with conventional thinning at pit hardening, both fruit size and yields were slightly greater on blossom thinned limbs but more research is needed to confirm these results. In a comparison of fruit development on shortened and uncut laterals, fruit developed at a faster rate and was larger at harvest on the shortened laterals but again more detailed research is required.

Herbicides

Comparison of various orchard management techniques incorporating the pre-emergence herbicide, terbacil, at Yanco since 1969, has so far produced no differences on tree growth or cropping. Weed control has been satisfactory and so far only the first application of terbacil, in spring 1969, at 3 lb per acre, has been necessary. Evaluation of a wide range of herbicides on mature and young peaches and on newly planted prunes will begin at Bathurst in spring 1971.

Winter Chilling Records and Varietal Chilling Requirements

Thermograph records were maintained in six coastal orchards, on the Research Stations at Bathurst, Yanco and Narara and at Hawkesbury Agricultural College to record the number of hours of winter chilling (under 45°F) experienced. This information can be used as a guide to the suitability of the districts for planting some of the newer varieties. Tests continued at Yanco to determine the chilling requirements of the most promising canning peach varieties in variety trials.

Post-Harvest Rot Control

Semi-commercial trials with peaches carried out from Bathurst established that a post-harvest immersion of fruit in a mixture of benomyl and dichloran was very effective in the control of the two common fruit rots — brown rot, *Sclerotinia fructicola*, and transit rot, *Rhizopus nigricans*. Following its registration in 1970, many growers in coastal and tableland districts used benomyl dips in the 1970–71 season with good out turn in what was a bad year for fruit rots, especially brown rot.

Apricot "Breakdown" in Cans

"Breakdown" of apricots in cans has been a problem since 1968. Trials in association with the CSIRO Division of Food Research, and with the co-operation of the Leeton and Golden Circle Canneries, established that the condition can be induced by inoculating the fruit with *Rhizopus nigricans* before processing. Further trials this year were designed to establish whether infections of this disease were the main or only cause in commercial packs, as appears to be the case. Results are yet to be evaluated.

IRRIGATION RESEARCH

Establishment of Plantings

Evaluation of trickle irrigation techniques for the establishment of new plantings continued at Yanco. The four irrigation treatments replacing 40, 60, 70 and 80 per cent of the net evaporation from a wetted soil area of 9 square feet per tree were adequate for apple, citrus and grape vine establishment, but peaches required a 50 to 100 per cent increase in water application rates to maintain the wetted area as the 1970–71 growing season progressed. To date there are no differences in tree growth between the irrigation treatments, but trees under black polyethylene mulch made better growth than those under bare soil.

At Bathurst, both fruit yields and fruit size increased with increasing amounts of supplementary irrigation water applied to four year old peach trees. There was no need to apply water this season through the sprinkler system used for comparison with trickle irrigation treatments, because rainfall was adequate. However crops were heavier in this treatment than in the non-irrigated control and in the lowest trickle application rate (20 per cent evaporation replacement). An apparent influence was that irrigations in the previous season had promoted better development of fruiting wood. Trees receiving the greatest quantities of water matured their fruit earlier. The highest trickle application rate, 60 per cent replacement of evaporation, appeared to have adversely affected tree health at the end of the season.

A study of the effects of various rates of water application using a trickle irrigation system on bananas began at Alstonville in 1970. A district trial at Dunoon to study the establishment of macadamias under trickle irrigation was commenced in 1971.

The establishment of avocados by trickle irrigation at Dareton continued to be most satisfactory, except for trees at the lowest rate of one gallon per day. Two-year old trees receiving three gallons per day or more have done particularly well.

The trickle method of irrigation has been adopted for a substantial portion of citrus planted at the Cudgel Demonstration Orchard.

Mature Plantings

Banana yields were increased significantly by supplementary watering from ground level sprinklers in a three-year trial at the Tropical Fruit Research Station, Alstonville. A water budget method based on evapotranspiration was more accurate than one based on soil moisture measurement. Small amounts of water (30 to 40 points) applied every three to five days in dry periods gave the best results. Fruit weight, hand number, finger number, fingers per hand and fruit grade were all increased as the amount of water available to the plants increased.

The trickle irrigation trial at Bathurst Agricultural Research Station on mature plantings of Granny Smith, Delicious and Jonathan apples, completed its second season. In the first season, water was applied in amounts which equalled 20, 40 and 60 per cent of water lost by evaporation based on losses from a standard evaporimeter. The 60 per cent treatment supplied more water than required and ponding occurred. Although yield was increased with Jonathan and Granny Smith, continuing this treatment would have adversely affected tree health eventually.

In the second season the rate of water application from the microtubes was reduced from two gallons to one gallon per hour. In the treatments, the percentage replacement of evaporation loss was reduced to 20, 30 and 40 throughout the season, calculated on a 20 ft square wetted area rather than a 24 ft square. Rainfall throughout the season was good with a short dry spell in January and a longer dry period after mid-February. Although natural soil water was never really short, there was an increase in crop yield in all three varieties with irrigation. Granny Smith, with a longer maturity period, gained most benefit. The increases in yield were proportional to the amount of water applied. The larger fruit from irrigated trees had a better skin texture than controls. There was a heavy crop on all trees and there was very little bruising and no water core in any treatments. Tree size and growth also increased proportionally to the amount of water applied. The increments of butt circumference, shoot lengths and pruning weights were larger than in the control and were generally greatest with Granny Smith.

At the Griffith Viticultural Research Station the Shiraz irrigation trial in which various regimes of trickle and furrow irrigation are being compared was in its second season. Yields, although lower than for the previous season, followed a similar pattern in relation to treatment effect. There was little difference in yield between trickle irrigation applied daily or every two days (using a crop factor of 0.5) and irrigation by conventional furrow methods. Yields were suppressed by withholding water during the period from bud-burst to veraison and from veraison to harvest; and by daily trickle irrigation on the basis of a crop factor of 0.25. Varying berry size was the main factor contributing to yield differences. Water use in the trickle irrigation treatments (crop factor 0.5) was only half that of the furrow irrigated treatments.

At Narara, it was found that one or two tricklers per tree were insufficient for mature double-planted citrus trees even in winter, due to excessive infiltration in the light soils and insufficient lateral spread. An increase in the numbers of tricklers to apply the same quantity of water was necessary.

Tile Drainage

A short period of high water tables during the summer of 1971 was without any adverse effect in an experiment established at Griffith in 1961 to study tile drains installed at spacings of 40 to 120 feet apart and at depths of 3 and 5 feet on plantings of peaches, prunes, oranges and vines. There were previous periods of induced high water table levels in the experiment in the spring of 1968 and the autumn of 1969.

It is now apparent that tile drains installed according to the standard design criterion used in the MIA are more than adequate to protect orchards from water-logging and subsequent soil salinity build-up provided surface drainage is adequate. The spacings may be too cautious in the case of crops such as citrus and grapes; wider spacings than currently recommended may be safe.

DISINFESTATION OF FRESH FRUIT AGAINST QUEENSLAND FRUIT FLY

Bananas

A three-year programme of disinfestation studies on bananas at Gosford Citrus Wastage Research Laboratory was completed. Fumigation of fruit with ethylene dibromide (EDB) at 10, 12 or 14 oz per 1,000 cu ft for two hours at 70°F or higher temperatures caused high mortalities of fruit fly eggs, larvae and pupae. Summer bananas tolerated fumigation at 14 to 15 oz EDB per 1,000 cu ft without skin injury, but winter bananas from northern N.S.W. tolerated only 10 to 12 oz. Fumigation at 60°F fruit temperature resulted in considerable skin injury.

Dipping bananas in dimethoate at 500 or 300 ppm for 30 seconds at 70°F or 50°F caused very high mortalities of fruit fly eggs and larvae. Dimethoate was relatively ineffective against fruit fly pupae. Application of dimethoate as a flood or spray treatment for bananas appeared to be a satisfactory alternative to dipping, subject to suitable design of equipment.

Recommendations were submitted by the Fresh Fruit Disinfestation Committee to the Commonwealth and States Horticultural Committee for the acceptance of fumigation at 12 oz EDB per 1,000 cu ft at 70°F for two hours or application of dimethoate at 300 to 500 ppm as a suitable disinfestation treatment for quarantine purposes, subject to the advice of the National Health and Medical Research Council.

Tomatoes and Capsicums

A two-year programme of disinfestation studies on tomatoes and capsicums commenced at Gosford. Methyl bromide fumigation of tomatoes will be investigated when suitable fumigation equipment and facilities are completed. It has previously been reported that tomatoes are injured by ethylene dibromide.

In preliminary tests, capsicums have tolerated fumigation with EDB at rates up to 26 oz per 1,000 cu ft at 70°F without skin injury, although colour development was retarded. Mortality studies with capsicums are progressing well.

RESEARCH STATIONS AND LABORATORIES AFFECTING THE FRUIT INDUSTRIES

Alstonville Tropical Fruit Research Station

The developmental programme of the Station continued with new plantings of bananas, avocados, pineapples and papaws. A dehydrator was installed to assist in preparation of banana samples for analyses. An infra-red gas analyser was received for banana plant growth investigations. Automatic irrigation and drainage sampling facilities were installed.

One of the three fruit research officers, whose position was previously supported by industry funds, was transferred to another station. A replacement would enable an intensification of research on tropical fruits other than bananas, especially avocados and macadamias.

Bathurst Agricultural Research Station

Filling of the vacant position for Fruit Officer (Research) allowed expansion of the research programme for stone fruits. Peach rootstock and clonal strain trials planted in 1970 have established well.

Dareton Horticultural Research Station

The staff of fruit research officers was increased from two to three by the transfer of a position and a research officer from Narara. This officer will continue his investigations on rootstock-scion relationships of citrus and supervise the important double spacing and nutrition trials.

Further plantings were made in the citrus mother tree block. The initial plantings have progressed; they will provide certified budwood within the next two to three years. All budwood purchases will be handled through the N.S.W. Bud Selection Society Ltd, which provided some funds for development of the block.

Gosford Citrus Wastage Research Laboratory

Co-operative investigations with the CSIRO Division of Food Research continued. Projects included problems in the post-harvest handling of citrus fruit and disinfestation treatments of bananas, tomatoes and capsicums against Queensland fruit fly. The disinfestation programme on bananas was completed.

One of the two Fruit Officer (Research) positions at the Laboratory became vacant in the latter half of 1970, but was filled in June, 1971, by the transfer of an officer.

Griffith Viticultural Research Station

The highlight of development during the year was the commencement of the building of an experimental winery. The winery will allow research projects to be examined for the effects of treatments on wine quality. The building and equipment will cost more than \$60,000.

A viticultural symposium conducted by the Royal Agricultural Society in Griffith in February, 1971, involved the station. Delegates inspected research plantings and vines were provided for the demonstration of mechanical harvesting. Staff of the station presented papers at the symposium.

Narara Horticultural Research Station

The Fruit Officer (Research) establishment was reduced from three to two during the year with the transfer of one position and an officer.

The Valencia rootstock and variety trial established in 1955 on old citrus land was terminated. It will be replaced in spring 1971 by a lemon variety and rootstock trial, propagations for which have been made. New land development proceeded at the Somersby section where already cleared land was drained and equipped for irrigation. Oranges and mandarins will be planted in spring 1971 for short-term trials. A number of small plantings of Citrus Improvement Committee projects were terminated and removed.

Virus-tested strawberry plants were produced in isolation at the Somersby section for distribution to runner growers. Land has been prepared for the extension of plantings when facilities and staff are available to establish a strawberry plant certification scheme.

North Ryde Fruit Preservation Research Laboratory

Development of the plastic tent method for CA storage of apples continued in storage investigations in co-operation with the CSIRO Division of Food Research. There was associated study of removal of accumulated ethylene from such rooms. Removal of ethylene will also be important in projected studies on plastic tent CA storage of bananas.

Other studies concerned the green-ripe disorder of bananas and the effect of CA storage and accumulated ethylene on the ripening of stored tomatoes.

Orange Agricultural Research Station

The second stage of a comprehensive trial with apples was planted in winter 1970. It compares four tree training systems in three varieties, each on four rootstocks. The third and final stage will be planted in winter 1971.

A cherry variety collection was established, arrangements were made for the planting of a group of Californian black walnuts to provide nuts for the raising of rootstocks and land is being prepared for a collection of walnut and filbert nut varieties.

Yanco Agricultural College and Research Station

An industry research grant from Jusfrute Ltd, a citrus processor, enabled expansion in the scope of citrus juice quality investigations. Automatic titration equipment for juice acidity determinations was purchased and purchase of a refractometer and improved juice reaming equipment is planned.

Stone fruit plantings were extended into a new area of land with the establishment of peach and prune rootstock trials, a clonal strain collection trial for peaches and areas for short-term trials and training studies for intensive plantings. Preparations were made for the planting of an additional area for short-term trials and a prune clonal strain trial in the coming season.

Cudgel Demonstration Orchard

This orchard was established on the Cudgel sandhills to demonstrate correct cultural procedures, desirable rootstocks, and other practices necessary for economic production of citrus on these and similar soil types in the Coleambally Irrigation Area. Establishment was assisted by Commonwealth Extension Services Grant funds. The initial plantings of 700 Valencia oranges on trifoliata rootstock are being watered by trickle irrigation. The planting density is approximately 400 trees per acre. Additionally, some 324 double-planted Lane's late navel on three rootstocks were established under drag hose irrigation. Further areas have been prepared for planting in spring 1971. A machinery shed, tractor and equipment have been provided and a house for the resident Field Assistant is being built.

Hawkesbury Agricultural College Orchard

Stone fruit plantings were maintained for demonstration to students. New peach and nectarine varieties are now well established. Other demonstrations for students include trickle and drag hose irrigation installations; use of soil moisture testing equipment; use of herbicides in a range of fruits; soil management; tree planting and pruning methods; and winter chilling needs for trees.

Wagga Agricultural College Orchard

Stone fruit, citrus and vine plantings for demonstrations to students were maintained as were the almond and olive variety collections and a small demonstrational planting of strawberries.

COMMITTEES AFFECTING RESEARCH

Fresh Fruits Disinfestation Committee

This committee comprises representatives of the Commonwealth Department of Primary Industry, the CSIRO, Queensland Department of Primary Industries, and the State Departments of Agriculture of N.S.W., Victoria and South Australia. Investigations centred at the Gosford Citrus Wastage Research Laboratory are reported under the heading "disinfestation of fresh fruit against Queensland fruit fly" in this report.

Banana Research Advisory Committee

Representatives of the Commonwealth Department of Primary Industry, the CSIRO, Queensland Department of Primary Industries, N.S.W. Department of Agriculture and the Australian Banana Growers' Committee, comprise the committee. Annual meetings have reviewed the banana post-harvest research programme undertaken at the Alstonville Tropical Fruit Research Station, the Sandy Trout Food Preservation Research Laboratory of the Queensland Department of Primary Industries and the CSIRO Division of Food Research, North Ryde. The technical sub-committee meets prior to the main committee. This year the committee met at Coffs Harbour to discuss progress of research during the last 12 months, and to allocate funds for research in 1971-72 which will be the last year of the 10 year research programme on which the formation of the committee was based.

Besides reviewing progress, and proposing programmes for 1971-72 on banana maturation, ripening, packaging and post-harvest disease control studies, finance was allocated for an economic study of some facets of retail marketing and consumer acceptance of bananas by the Business Research Institute of the University of New England.

The committee also sponsors an annual meeting of banana post-harvest investigators to discuss details of their research programmes and formulate lines of future research. This year, the meeting was held at the Tropical Fruit Research Station.

Banana Weevil Borer Committee

The committee comprises representatives of the Banana Diseases Control and Development Co-operative Ltd, and the N.S.W. Department of Agriculture with finance provided by the Co-operative. The programme to contain and control weevil borer infestations in the Coffs Harbour/Nambucca area includes a survey to define the extent of infestations and a detection and treatment scheme.

Citrus Wastage Research Committee

This committee consisting of representatives of the Department and the CSIRO Division of Food Research met at Gosford twice during the year to review current research programmes and other activities of the Citrus Wastage Research Laboratory. Recommendations for the use of thiabendazole (TBZ) to control mould wastage after harvest were approved for circulation to the industry in N.S.W. and to other state Departments of Agriculture. The committee also approved the production of a film, in co-operation with the CSIRO film unit, on the post-harvest handling and treatment of citrus.

Citrus Improvement Committee

This committee of senior officers of the Division of Horticulture and the Biology Branch met twice to review projects and to arrange propagations for new citrus research projects. A highlight was the recommendation that two citrange rootstocks, developed by the committee, be named Bowman and Benton. These stocks have considerable potential especially as re-plant stocks for lemons. A far-reaching recommendation was that this Department should develop a research and extension centre for the container production of citrus nursery trees at the Horticultural Research Station, Narara.

Commonwealth Committee for Co-ordination of Fruit and Vegetable Storage Research

This committee of representatives of the CSIRO Division of Food Research, D.S.I.R. Division of Plant Diseases, New Zealand, and State Departments of Agriculture meets biennially to discuss progress and review programmes of post-harvest research on fruit and vegetables by the various organizations. The most recent meeting was in Adelaide in September, 1970.

Murray citrus sub-committee. — This sub-committee met at the Citrus Wastage Research Laboratory, Gosford, in October, 1970. Highlights of the discussion included: the need for research into the problem of *Alternaria* rot of stored oranges, and its relationship to the use of TBZ for mould control; the need to collect data on the relationship between rind oil rupture pressure, environmental influences and the subsequent incidence of oleocellosis; and the need for demonstrations on the control of rind staining of late hung navel oranges by the application of gibberellic acid sprays in May-June.

Committee for Fruit and Vegetable Storage Investigations in N.S.W.

This committee of representatives from the N.S.W. Department of Agriculture, the CSIRO Division of Food Research and universities in the Sydney area meets annually to review programmes of fruit and vegetable post-harvest investigations being carried out in N.S.W.

Central Coast Agricultural Research and Extension Committee

This industry-sponsored committee assists the co-ordination of agricultural research and extension in the Gosford-Wyong district and organises field days on topical subjects. In the two years ending June, 1971, the committee, through funds provided to it by the Central Coast (N.S.W.) Citrus Marketing Board, made a substantial financial contribution for the purchase of research equipment for investigation of rind blemish of citrus.

Citrus Co-operative Bud Selection Society Ltd

This society, a non-profit making organization, has operated for 40 years for collection and distribution of selected budwood to nurserymen. The committee of the society includes representatives from nurserymen, citrus growers and the Department. The problems associated with the supply of certified budwood from approved blocks of trees on private orchards will be eased within two to three years when budwood will be available from the Department's parent tree planting at the Horticultural Research Station, Dareton.

Vine Improvement Research Committee

This committee comprises representatives from State departments of Agriculture, the CSIRO, the Australian Wine Research Institute and the Australian wine and dried vine fruit industries. The annual meeting at Merbein in April, 1971, examined progress made in the past season in vine improvement research. Items discussed were nomenclature of vine clones in Australia, use of nematode and phylloxera resistant rootstocks and their propagation, clonal selection, register of imported and Australian clones, virus indexing, vine breeding, variety importation and experimental wine making procedures.

The committee also discussed experimental wine making techniques. State departments of Agriculture, including this Department, and CSIRO reported that they were, or were about to commence, making experimental lots of wine to assist with the quality assessment of new wine varieties or clones and to help in the assessment of experimental treatments.

MIA Irrigation Research and Extension Committee

This industry-sponsored committee (IREC) continued to review research and extension needs in the MIA. Most fruit growing matters were handled by a horticultural sub-committee and some were referred to the Department for attention. A planting trends report was prepared by the Division from figures collected in the 1969 MIA Fruit Tree and Grapevine Census and presented to the annual meeting.

Viticultural sub-committee. — This sub-committee formed to enlist the guidance and support of industry for the research programme of the Viticultural Research Station met in May, 1971, to review the 1970–71 season's work. Particularly important topics were: mechanical harvesting and the need to create a greater awareness by growers of associated trellis requirements; the distribution of high yielding clones; the need for cost-benefit analysis of different trellis types; and the establishment of a daily advisory service to assist growers in timing irrigations.

Dried Fruits Research Committee

Commonwealth legislation enacted in April, 1971, provided for the establishment of a dried fruits research fund financed by the dried fruit industries and the Commonwealth Government. The first meeting of the committee formed to allocate finance was held in June, 1971. The committee comprises representatives from the N.S.W., Victorian and South Australian Departments of Agriculture, CSIRO, Department of Primary Industry and growers and packers of dried fruits. At the first meeting the scale of levies on dried fruit production for the financing of the research was set and it was decided that the first allocation of funds for research projects would be made in November–December, 1971. It is expected that \$211,000 will be paid into the fund in its first year of operation and thereafter an average of \$118,000 per annum will be derived from industry levies and a matching Commonwealth contribution.

Committee for Co-ordination of Fruit and Vegetable Processing Research

This committee comprises representatives of the CSIRO, the N.S.W. Department of Agriculture, the University of N.S.W. and the canning industry in the state. The full committee did not meet this year. The sub-committee investigating the breakdown of apricots in cans met to review the work of the previous season and plan a programme for 1970-71.

Deciduous Fruit Tree Improvement Committee

This committee of officers of the Division of Horticulture and the Biology Branch aims to prevent the spread of virus diseases of deciduous fruit trees by selecting suitable propagating material and by making the selections available to nurserymen. Virus-free clones of stone and pome fruits are being obtained from interstate sources and will be increased to provide propagation material for nurserymen. Facilities for the isolation of stone fruit mother tree material and multiplication of virus-adjusted stone and pome fruit propagation material when the various national fruit tree repositories become operative within the next five years were considered.

N.S.W. Section of the Australian Canning Fruits Advisory Committee

This committee met twice under the chairmanship of the Principal Fruit Officer (Stone Fruits) to review the planting and production of canning fruits in the MIA. The committee has been concerned with the decrease in bearing areas of apricots and peaches in the MIA. It recommended that bearing areas should be maintained until marketing opportunities are clearer.

15th Australian Canning Convention

The 15th Australian Canning Convention in Melbourne was attended by the Chief of the Division and the Principal Fruit Officer (Stone Fruits). Among the subjects discussed were the possible use of the inter-firm comparison programme of the Department of Trade and Industry for improving the efficiency of canneries, the need to intensify research into the development of new fruit products and the difficulties that will face the industry if Great Britain enters the European Economic Community.

Sub-Committee on Pesticides Residues in Plants and Plant Products

This sub-committee of the Department's Pesticides Policy Committee reviews the pesticide residue situation in respect to plants and plant products, and recommends priorities in residues research. Residue analyses for benomyl in peaches, bananas and citrus and analyses for bromine residues in bananas were given top priority and analyses for bromine residues in tomatoes were added to the programme.

EXTENSION SERVICES TO FRUIT INDUSTRIES

GENERAL

Extension Activities

District officers of the Division of Horticulture contributed to 87 field days and 232 meetings, the preparation of 206 press articles, 12 articles for the Agricultural Gazette of N.S.W., 157 radio broadcasts and 12 television performances. Visits were made to 5,696 orchard properties.

Spray Calendars

Spray recommendations, issued as calendars or wall charts for fruit growers, have been prepared for a number of years by officers of the Division and of the Biological and Chemical Research Institute. The latest edition for growers in the tablelands and coastal highlands has been enlarged and varied to include the Young district. Together with a calendar for MIA growers, it services all the major pome fruit production districts in N.S.W. Spray guides for coastal stone fruits, citrus and viticulture have also been reviewed.

Assistance to Various Authorities

The Division assisted the Water Conservation and Irrigation Commission, Department of Lands and the Rural Bank in relation to applications by fruit growers for financial assistance, rural reconstruction and closer settlement. Requests about war service land settlement investigations and hail damage to fruit crops required most attention. Enquiries relating to claims for damage to fruit trees and fruit crops alleged to have been caused by hormone sprays used by the Electricity Commission, the P.M.G's Department and Local Government instrumentalities continued to decline.

Financial Assistance to Fruit Growers

Many fruit growers were in financial difficulties due to widespread hail damage to fruit crops. As a result of inspections by officers of the Department, the Minister made representations to the Premier and Treasurer for financial assistance for orchardists placed in necessitous circumstances by hail damage. Approval was given for assistance to affected growers by loans through the Rural Industries Agency of the Rural Bank of N.S.W. Loans were made available to fruit growers on the New England, at Orange, Bathurst, Batlow and Cudgel and in the Wollondilly Shire and the County of Cumberland.

EXTENSION ACTIVITIES OF SPECIAL INTEREST

Citrus Industry

Lemon industry symposium. — The suitability of the coastal climate of N.S.W. to lemon culture and the increasing degree of specialisation in this crop induced the Arcadia-Galston branch of the Agricultural Bureau to sponsor a lemon industry symposium at Arcadia in October, 1970. The day's programme was provided largely by officers of the Department, with some support by CSIRO and industry. More than 70 participants registered for the symposium.

Post-harvest treatment and handling of citrus fruit. — A three-day extension school was organized by the Citrus Wastage Research Committee at Gosford in April, 1971. Most of the people at the school were extension, research and regulatory officers of this Department but officers of Queensland, Victorian, South Australian, Western Australian and Commonwealth departments also attended. The purposes of the school were to familiarise officers with the more recent research findings in post-harvest treatment of citrus fruit and to facilitate extension of results to Australian citrus packing houses and growers. Professor Irving L. Eaks of the University of California was a visiting speaker.

Citrus research and extension conference. — A two-day research and extension conference was held in April, 1971, at Gosford for research, extension and regulatory officers of the Division who are actively engaged on citrus. Topics included citrus improvement, management practices, trickle irrigation, nutrition, herbicides, grading regulations and proposed new fields for research. A review and outlook for the citrus industry was also presented.

Pome Fruits Industry

Rootstocks, planting densities and tree training techniques. — Emphasis has been directed towards greater appreciation by growers of the association between rootstocks, planting densities and tree training techniques. Meetings were held with growers at Bathurst, Batlow and Orange and field demonstrations at Batlow, Bilpin and Orange. In addition, two articles were published in the *Agricultural Gazette*.

Post-harvest symposium. — Following the poor out-turn of some pome fruit from controlled atmosphere storage in October, a meeting of fruit growers, cool store operators, agents and representatives from the CSIRO and the Department was convened by the Division of Horticulture. It was pointed out that the breakdown in this fruit was primarily the result of inadequate management practices in the field rather than the effect of controlled atmosphere storage. Subsequently, the Division organised a pome fruit post-harvest symposium at Orange in February, 1971. The need for fruit growers to pay attention to the production of quality fruit was emphasised. It was agreed that, whilst controlled atmosphere storage could do much to improve the quality of fruit presented to the consumer throughout the year, it was essential to ensure that only suitable fruit were subjected to long-term storage.

Stone Fruits Industry

Variety selection. — Varietal improvement work with dessert stone fruits was featured at the biennial field day of the Agricultural Research Station, Bathurst, and at field days on district plots at Arcadia and Menangle. Excellent quality samples of all recently introduced dessert peach and nectarine varieties were displayed at Bathurst. The field days at Arcadia and Menangle were held when the early-maturing varieties were mature on the trees. Four recently introduced peach varieties (Maygold, Starking Delicious, Coronet and Redhaven) and two local selections (Fragar and Glenalton) have been favourably received by growers and market buyers. They are now being extensively planted to supplement the main mid-season and late-maturing yellow fleshed varieties, Halehaven, Blackburn and J. H. Hale.

Pruning and tree training. — Long lateral pruning of peaches has increased production in many orchards; the increased yields of peaches which resulted in a record crop in the MIA is considered to have been partly due to the adoption of long lateral pruning by a number of growers. The system was demonstrated in the Maitland district and at other pruning field days during the year.

Demonstration plots were established at Young and Griffith to show methods of training prune trees to forms expected to be better suited for mechanical harvesting, and plots were established at Bathurst, Yanco and Darkes Forest to demonstrate the training of closely planted peach trees. Plots were also established at Orange and Lakesland to demonstrate the development of high headed cherry trees on bacterial canker resistant rootstocks.

Irrigation. — Growers on the MIA have been impressed by the value of following recommended practices with broad based furrows and flood irrigation to alleviate salinity problems. Assistance has been given in most districts with the installation of trickle irrigation systems and developments in the use of the system are being followed closely by all District Fruit Officers. Excellent results have been obtained with trickle irrigation in establishment of fruit trees but a satisfactory assessment of the system on mature trees has not been possible due to favourable rains in most areas. Very substantial savings of water have been reported by strawberry growers who are using trickle irrigation extensively on new plantings.

Supplementary irrigation and the possibilities of "water-harvesting" were discussed at a field day at Young. A bitumen coated water catchment demonstration has been established in the district. Growers were informed of the costs of this method of increasing the amount of water available.

Tropical Fruits Industry

Post-harvest life of bananas. — Recommendations are being made to industry through the Banana Research Advisory Committee on the use of polyethylene bags in banana packaging. This technique extends the green life of bananas; a further increase in green life can be achieved by introducing potassium permanganate into the bag to absorb ethylene. The technique would be of particular value for use on packs intended for distant markets.

The fungicide, thiabendazole, has been approved for use on bananas within the limit of 3 ppm residue in the whole fruit. A provisional residue tolerance of 1 ppm has been recommended for the fungicide, benomyl, when used on bananas as a post-harvest treatment. Both materials have performed very well in trials and commercially, and should greatly improve post-harvest disease control and general fruit quality.

N.S.W. Avocado Growers' Association. — The N.S.W. Avocado Growers' Association was formed after ratification of a constitution in November, 1970. Its objectives include liaison and co-operation with the Department in extension and bringing matters concerning the industry to the attention of the Department for investigation.

Viticultural Industry

Viticultural symposium. — A viticultural symposium organised by the Royal Agricultural Society, in conjunction with the Department and IREC, was held in February at Griffith. The papers were orientated toward practical aspects of viticulture in which improvements had been effected in recent years. The papers presented by officers of the Department were based almost entirely on its viticultural research programme. Subjects included clonal selection, irrigation, pests and diseases, varieties, trellising, mechanical harvesting and costs of vineyard establishment. Tile drainage, vine pruning, planting distances and the use of herbicides, harvest aids and growth regulators in vineyards were discussed and demonstrated during field sessions. Some 200 delegates from vineyards and wineries throughout Australia attended.

Mechanical harvesting. — Increasing difficulty in obtaining harvest labour has given greater impetus to investigations of mechanical harvesting of grapes. Harvesting systems, using mechanical aids in conjunction with manual labour, developed in the Hunter Valley and MIA have shown potential in increasing the efficiency of manual pickers. With fully mechanised harvesters, CSIRO has continued to test an imported one-wire machine, and considerable interest is also being displayed in the prototype of a self-propelled, half row mechanical harvester being developed by an Australian engineering company.

Mechanical harvesters were demonstrated to growers at several field days and at the viticultural symposium at Griffith. As it is apparent that mechanical harvesting of grapes will become a commercial proposition soon, an extension programme has been directed to ensuring that trellises in new plantings will be suited to mechanical harvesting. Firm recommendations for trellises suitable to mechanical harvesting were publicised following meetings between industry representatives, the Departments of Agriculture of Victoria and N.S.W. and CSIRO.

Grit in dried vine fruit. — Minimising grit contamination became more important following a ban on the export of dried vine fruit with grit content exceeding 30 grit units. A grit survey in the Lower Murray district demonstrated correlations between grit level and factors such as soil type, pre-harvest cultivation and the use of rack spraying. Rack sprayed fruit was invariably low to moderate in grit content irrespective of soil type. The highest grit readings were obtained in fruit

from blocks with light soil types cultivated prior to harvest and in which the fruit was dipped rather than rack sprayed. Growers were given intensive advice on minimising grit in situations where high grit levels were likely. Rack spraying was encouraged and was used extensively, particularly during the latter half of the drying season.

Nematode-resistant rootstocks. — Planting of nematode-resistant rootstocks was promoted in the Lower Murray district in replant situations, nematode infested soils and on light soil types. Demand for these rootstocks was extremely strong — all available rootstocks were allocated to growers. The practice of grafting the rootstocks in the field was discouraged, due to difficulties experienced, and a nursery chip budding technique was demonstrated to growers.

Herbicides. — The use of herbicides in vineyards was encouraged with good results in several districts. In the Lower Murray district the use of pre-emergence herbicides for under-vine weed control increased. Advice to individual growers was necessary to ensure safe and effective use because of the possibility of toxicity to the vines. In the Hunter Valley there was also widespread acceptance of herbicides for under-vine use and the number of vineyards using this method trebled during the year. Nevertheless, the concept of total herbicide weed control in vineyards has yet to be adopted widely because of the greater risk of phytotoxicity with vines, than with other crops and the slightly higher cost of chemical control than normal cultivation.

Packing and Packaging

The Fruit Packing Instructor conducted two packing schools in the northern tablelands, and packaging demonstrations at Murwillumbah, Duranbah, Batlow, Bathurst and Orange. There were 14 investigational projects including tomatoes, pears, apricots, apples, peaches, pawpaws, bananas and pineapples. The Instructor participated in meetings at Newcastle (new markets), Maitland (vegetable growers), Cudgen (vegetable growers), N.S.W. Chamber of Fruit and Vegetable Industries (fruit growers from Orange), Griffith (citrus packaging seminar), Gosford (citrus school), Orange (pome fruits post-harvest symposium), Melbourne (fruit packaging) and Sydney (Sydney Farm Produce Market Authority's packaging symposium). In addition he attended four conferences, published five articles in the *Agricultural Gazette*, contributed a number of articles to country newspapers and participated in television presentations at Orange and Tamworth.

FRUIT INDUSTRY TRENDS

CITRUS INDUSTRY TRENDS

Seasonal Conditions

Weather was much more favourable for citrus growing in inland irrigation areas than in coastal districts where sharp contrasts occurred in the weather. Rainfall recordings at Gosford typify the coastal drought during the winter of 1970. Only 4 inches of rain fell in the five months from April to August, whereas the 30-year average is 21 inches. The drought reduced the size of maturing citrus fruit and predisposed them to injury by frosts which were also severe as a result of the drought. Heavy losses of navels, Valencias and mandarins occurred due to frost along the Hawkesbury River and in the lowlands and valleys at Gosford and Paterson. Fortunately, good falls of rain in September conditioned trees sufficiently to set heavy crops for the current season. High rainfall was recorded from November to February but the autumn was again dry.

Production

Record citrus crops harvested inland off-set the reduced coastal crops and resulted in a state record. The pattern is reversed for the crops set in the spring of 1970 and currently maturing or being harvested.

The final main crop estimate for citrus in N.S.W. for the 1970–71 season was 7,500,000 bushels, plus 160,000 bushels of summer crop lemons and 50,000 bushels of second crop Valencias; an overall 7,710,000 bushels. This estimate was some 690,000 bushels more than 1969–70 and will still be considerably higher than the forecast for 1971–72 crops even when second crop fruit is finally taken into account.

The final main crop production estimate for 1970-71 and the preliminary crop forecast for 1971-72 are:

	1970-71 Final estimate (bushels)	1971-72 Preliminary forecast (bushels)
Navels	1,935,000	1,900,000
Valencias	4,195,000	3,530,000
Commons	35,000	39,000
Sevilles	15,000	11,000
Total oranges	6,180,000	5,480,000
Lemons	845,000	715,000
Mandarins	255,000	390,000
Grapefruit	220,000	195,000
Total citrus	7,500,000	6,780,000
Plus second Valencia crop	50,000	
And summer lemon crop	160,000	
	7,710,000	

Exports of Citrus

Exports of citrus from Australia totalled 1,224,000 bushels of which South Australia provided 66 per cent. Exports from the MIA were 69,800 bushels of Valencias and 19,100 bushels of navels, a 30 per cent decrease on 1969-70. Exports from Sunraysia to which N.S.W. contributed 60 per cent, were 93,100 bushels of Valencias and 52,200 bushels of navels. The Valencia exports, which included 60,000 bushels to New Zealand, were lower than in recent years. However navel exports reached 52,200 compared with 32,000 in 1969-70.

Exports through the port of Sydney increased by 14,000 to 94,500 bushels of which 60,000 bushels were shipped to Singapore. Other exports from Sydney were 1,880 bushels of mandarins and 4,019 bushels of lemons and grapefruit. Exports from the MIA and Sunraysia were largely through the port of Melbourne.

Citrus Planting Statistics

	1969	1970		Number of trees
	Area	Area		
	(acres)	acres	% non- bearing	
Oranges	28,304	27,215	14	3,013,930
Lemons	2,847	2,972	19	332,201
Mandarins	2,596	2,532	25	291,721
Grapefruit	749	733	36	84,352
Sevilles	74	56	19	6,141
Total	34,570	33,508	16	3,728,345

Fruit planting statistics for December, 1970, showed a sharp decline in citrus acreage, particularly the acreage of oranges, but this was partly due to errors in the previous season when MIA statistics were collected separately. The latest figures should provide an accurate reference for future comparisons.

Alternate Bearing

A major problem of Valencia production in Australia is the alternate cropping pattern in which light crops follow heavy. Alternate bearing creates problems for growers, and processors, and for export and domestic marketing. The following table illustrates the variations in production for the citrus districts of N.S.W. for the 1970-71 and 1971-72 seasons. The State total is expected to be similar in both seasons because the "on" years for the inland and coast are different.

District	Valencia Oranges (bushels)			
	1970-71		1971-72	
Gosford - Newcastle	380,000		1,000,000	
Windsor - Parramatta	360,000		520,000	
Campbelltown	22,000		55,000	
Total Coastal		762,000		1,575,000
Narromine - Bourke	130,000		100,000	
Murrumbidgee Irrigation Areas	1,700,000		1,000,000	
Murray Irrigation Areas	1,600,000		850,000	
Total Inland		3,430,000		1,950,000
Total N.S.W.		4,192,000		3,525,000

Processing

The Australian citrus industry has relied on the Valencia orange for juice processing because of its long harvest season and its suitability for both fresh marketing and processing. The Department is attempting to overcome the alternate cropping of Valencias. The season for orange processing also needs to be spread. Processors have been interested only in lemon processing during the winter because there are problems that detract from the processing value of navel oranges. Recently, processors have indicated willingness to expand plants to process oranges and lemons at the one time, and that they would be interested in growers producing common oranges to extend the processing season.

Processors could expand their markets within Australia if more regular supplies of citrus could be assured. At present storage facilities are taxed to the limit and, in any case, storage of concentrate from one season to the next is costly.

With the record production of Valencias on the Murrumbidgee and Murray Irrigation Areas, it is estimated that over 100,000 tons of Valencias were processed in Australia during 1970-71. On the MIA, 23,500 tons of Valencias were processed locally in addition to considerable quantities supplied to Sydney and Gosford processors.

The intake of navel oranges by factories in Australia has increased ten fold since 1965, reaching 17,490 tons in 1970. Lemon processing also reached a record 17,000 tons. The total amount of citrus processed in N.S.W. is difficult to establish, but is approximately 50 per cent of the Australian total of around 135,000 tons of fresh citrus.

The per capita consumption of processed citrus in Australia has increased 175 per cent over the past five years and has reached 22 lb annually compared with 59 lb in U.S.A. As in other advanced societies, the consumption of fresh citrus has declined by 25 per cent during the same period.

Demand for Grapefruit

The increased demand for grapefruit that commenced as a diet fad two years ago appears to have stabilised. Final figures are not available for 1970–71 but in the year ending June 30, 1970, the equivalent of 1,490,000 gallons of single strength grapefruit juice and some 30,000 bushels of fresh fruit were imported into Australia. For the three months ending September, 1970, 463,500 gallons were imported. Grapefruit production in 1970 was 220,000 bushels in N.S.W. and 650,000 bushels in the whole of Australia. The import of juice in 1970 was equivalent to over 1,000,000 bushels of grapefruit. It is not likely that present plantings will meet this level of demand, so further plantings are warranted.

POME FRUIT INDUSTRY TRENDS

Seasonal Conditions

Most of the season generally favoured tree growth and crop production but some influences significantly reduced the overall quality of crops produced at Orange, New England, Batlow, Oakdale and Bathurst. Hail caused the most damage. Its effects were accentuated because this was the second consecutive season in which many growers have experienced substantial damage. In addition, low temperatures in tableland districts during October and November, 1970, damaged much fruit. Below freezing temperatures in the post-blossom stage resulted in many thousands of bushels being russeted and malformed.

Prolonged wet periods during the spring months in major districts resulted in inadequate control of apple and pear scab, and the level of scab inoculum is now heavier in many orchards than for some years.

Inland districts, such as Griffith, Leeton and Forbes, had a reasonably favourable growing and production season.

Production

The 1970–71 apple crop was a record, estimated at slightly greater than 5,000,000 bushels. This exceeded the 1969–70 crop by 1,200,000 bushels and also exceeded the average production for the past five years by the same amount. Only slightly more than half the 1970–71 crop was of sufficient quality to be eligible for Fancy grade. Hail damage was the main reason for downgrading.

The 1970–71 pear crop was estimated at 700,000 bushels, 200,000 bushels less than the previous year's record crop. The estimated average production for the last five-year period was 680,000 bushels.

As with apples and for the same reasons, pear quality suffered; Fancy grade packouts were about 50 per cent at Batlow, 25 per cent in New England and 70 per cent at Orange.

Plantings Statistics

The non-bearing acreage of apples was reduced from 3,373 to 2,944, whilst the bearing acreage increased from 15,763 to 15,804, a net decrease of 388 acres in total area. Of this area, 6,398 acres are planted to Granny Smith, the major apple variety in N.S.W., and Delicious and red strains of Delicious occupy second position with 4,679 acres. New plantings included 30 acres of Granny Smith and 170 acres of Delicious. There was considerably more interest in new plantings of Delicious, particularly the red strains, than in plantings of other varieties. Rome Beauty, once quite popular, has fallen into disfavour since CA storage capacity has increased appreciably. There was no plantings of this variety or its red strains during the past year. The trend to higher density plantings is clearly evident. The average density for all bearing apples is 101 trees per acre but, the average for apples planted in 1970–71 is 157 per acre.

The non-bearing acreage of pears was reduced from 583 to 519 and the bearing acreage from 2,739 to 2,675, a net decrease in pear plantings of 128 acres. Acreages of the major pear varieties are: Williams 1,350; Packhams Triumph 1,322; and Beurre Bosc 232. New plantings of pears during the year totalled less than 30 acres.

Processing

Although statistics are not available for 1970–71, it is obvious that the supply of fruit both for pie-pack and juicing exceeded demand. Significant quantities of Granny Smith suitable for these outlets remained unharvested in several districts. A reduction of \$7 to \$8 per ton in the price paid by processors for apples probably indicated a large carryover from the previous season.

An alcoholic apple cider manufacturing plant was established in 1970 at Campbelltown. Production was based substantially on imported cider concentrate and dessert variety concentrate from interstate. A crushing plant for local dessert varieties to permit blending of juice with the imported cider concentrate is now being installed. The plant will be of direct interest to N.S.W. growers, especially those in the Campbelltown district. Presumably there will continue to be no alternative to importing cider concentrate. The varieties of cider apples available in Australia are mostly old types which have been largely superseded overseas by better varieties. This Department imported five of the better overseas varieties from England in 1968. The release of two of these varieties from quarantine is expected in the 1971 winter, and of the other three in 1972. It will be 8 to 10 years before appreciable commercial quantities of fruit will be available from these varieties within Australia.

Provided alcoholic cider continues to be accepted by consumers, it is expected that the newly imported varieties will be planted by growers in some quantity. However, the quantity of low grade dessert varieties which can be used for blending with the imported cider concentrate is of more immediate importance.

The Australian Industry

The future viability of the Australian pome fruit industry is worrying most growers. The estimated Australian production of apples in 1970-71 was 24,000,000 bushels, whilst 1969-70 production was 19,400,000. The average annual production for the five years 1967-71 was almost 21,000,000 bushels, and for 1962-66 was 18,700,000. Whilst there has been a steady population increase, the export market is vital. Apple exports have fallen slightly from an annual average of 7,100,000 bushels for the five years 1961-65 to 7,009,000 for the period 1966-70. Unsatisfactory export trading over a number of years has resulted in the Commonwealth Government's participation in an industry stabilisation scheme, initially for five years, for export fruit sold at risk from this year. Without the scheme, N.S.W. growers could anticipate very severe competition from interstate growers.

Cool Storage

Controlled atmosphere (CA) cool storage as a commercial technique did not become important in N.S.W. or Australia, until 1967. Since then 30 CA storage units with a total capacity of 770,000 bushels have been constructed in this state. With the 3,656,000 capacity of other types of cool stores, N.S.W. now has a total capacity of 4,426,000 bushels.

The Department has advised fruit growers on the construction and management of cool stores in general. It has also been instrumental in developing a new and relatively cheap form of CA storage. A pre-fabricated copolymer film construction is erected within an existing store, permitting cool store operators to convert part of their existing cool room space to CA at relatively low cost. Following the first demonstration of the system in 1969, 11 units were constructed in 1970 and a further seven in 1971.

STONE FRUIT INDUSTRY TRENDS

Seasonal Conditions

A comparatively dry winter followed by favourable spring rains resulted in heavy setting of most stone fruit crops. Trees produced vigorous growth and fruit developed well in the early part of the season. However, production was markedly influenced by variable conditions over the state later in the season. Hailstorms damaged crops over fairly extensive areas in coastal and tableland districts and caused isolated damage in the MIA. A wet summer adversely affected fruit quality in coastal districts and the central tablelands, while prunes and some cherries failed to size satisfactorily at Young due to two dry periods. A comparatively dry autumn in the MIA was favourable for harvesting and a record crop of canning peaches and a heavy crop of apricots were produced.

Production

Canning fruits. — Conditions were favourable for fruit development and harvesting in the MIA following a moderate setting of apricots and a heavy setting of peaches. The apricot crop was affected, in part, both by frost and blossom blight in the spring, but average district yields were at the high level of 6.2 tons per acre. The crop was 6,769 tons from 1,084 acres. The crop exceeded cannery requirements, because markets for apricot concentrates had been lost. A proportion of the fruit was canned on the basis that growers will be paid only when and if the product is sold. A record crop of 25,473 tons of peaches was produced from a bearing area of 3,138 acres, an average of 8.1 tons per acre. The previous best crop was 21,284 tons from 3,668 acres bearing in 1966-67.

Prunes. — Heavy crops of prunes were produced in the Young district but fruit size was adversely affected by dry periods. Crops at Griffith were more variable than those produced in the previous season and production was down. The state crop has been estimated at 3,800 tons, about 200 tons less than in 1970.

Dessert peaches and nectarines. — Peach crops were very variable and overall production less than normal. Good crops set in most districts but quantities marketed were reduced by hailstorms and brown rot. Crops in the Bathurst and Orange districts suffered particularly from weather damage during harvest. Good crops of nectarines were produced in most districts and supplies to the Sydney market were heavier than normal. Prices for quality lines remained at a satisfactory level during the season but prices were depressed for the general run of fruit, particularly in moist periods when post-harvest rots were apparent in many lines.

Plums. — Moderate crops of Japanese varieties were marketed from coastal districts where fruit size was generally satisfactory but blemishes detracted from fruit quality. Inland crops of Japanese varieties were variable. Heavy crops were produced at Young but the fruit lacked colour due to dry conditions at harvest. Crops at Orange were mostly light due to frost damage at blossoming. Good crops of European varieties were produced in inland areas.

Cherries. — Heavy crops were set in all districts but weather conditions caused very heavy losses in some areas. Production recovered at Young following a number of light crop years caused by tree losses and damage in the drought years of 1966 and 1968. Although losses occurred this year from weather damage, production from Young was 398,360 quarter-bushel cartons, only 12,000 less than the record of 410,000 cartons in 1964. Whilst trees at Orange were carrying a very heavy crop, only a very small proportion was harvested due to hail damage and rain splitting. Almost 220 tons were delivered to the brinery but a proportion of these were red fleshed varieties. Market prices were generally depressed due to blemish and the incidence of post-harvest rots, but satisfactory prices were maintained for quality lines.

Plantings

Following a period of reduced plantings of stone fruits, more interest has been shown over the last two years in the establishment of new areas.

Apricots. — The area of apricots in the MIA decreased by 28.6 per cent, from 1,553 acres to 1,108 acres in the five years from 1965 to 1970. The bearing area decreased by 20.4 per cent, from 1,296 to 1,032 acres, in the same period. The acreage of early dessert apricots in the Kurrajong district continues to decline. Small additional plantings have been made at Menindee for supply to the early market.

Canning peaches. — The bearing area of canning peaches in the MIA declined from 3,692 acres in 1967 to 3,035 acres in 1969, but rose slightly to 3,098 in 1970. Small areas at Narrandera and Coleambally which supply fruit to the MIA canneries, increased the bearing area supplying the canneries to 3,138 acres.

Dessert peaches. — Interest is being shown in coastal areas in the planting of early, yellow-fleshed peach varieties, introduced recently, and the firm, white-fleshed variety, Fragar. Increased areas of Redhaven are being planted in tableland districts.

Nectarines. — Growers are keenly interested in recently-introduced, yellow-fleshed varieties of nectarines. They will be planting all trees available although planting of these varieties has not yet been recommended by the Department.

Prunes. — The areas of prunes are almost static. Increased plantings at Young are providing replacements for old trees going out of production, and areas in the MIA are being maintained. More interest has been shown in the crop since it has been demonstrated that it can be successfully harvested mechanically and plantings are expected to increase.

Plums. — Plantings of plums in coastal and tableland areas have been sufficient to maintain existing bearing areas but new plantings in the MIA have been insufficient to maintain the bearing area in that district.

Cherries. — Interest is being shown in new plantings both at Orange and Armidale but bacterial canker infections are adversely affecting the establishment of trees. Non-bearing plantings in these areas are barely sufficient to maintain production at present levels.

Plum Marketing

The acceptance of volume filling for small and medium sized plums has reduced marketing costs while single layer packs of large sized quality fruit have helped to develop a market demand for plums. Token consignments of Japanese varieties were exported successfully by airfreight to European markets and the possibility of export of supplies in containers is being explored.

Tariff on Imported Cherries

Following a Tariff Board decision to remove tariffs on imported cherries, a Special Advisory Authority was set up to advise the Commonwealth Government on the desirability of reinstating the tariff. After a report was submitted by the Authority the Government re-imposed tariffs. The new tariff is 6 cents per lb for brined cherries and 22 cents per lb for processed cherries. Local processors are obliged to use one lb of locally produced cherries for each three lb of imported cherries.

Mechanical Harvesting of Prunes

A significant development is a swing to full scale mechanical harvesting of prunes, particularly in the Griffith district where five whole-tree shakers were introduced for the 1970 season and an additional 11 for the 1971 season. Only two or three whole-tree shakers are so far in use at Young.

STRAWBERRY INDUSTRY TRENDS

Strawberry plantings increased from 67 acres in 1969 to 106 acres in 1970 and runner plant growers have reported a 50 per cent increase in sales for 1971. Nearly all plants used are being produced in isolated areas from either virus free material supplied by this Department or certified plants from the Victorian Strawberry Runner Growers' Association. Close attention being paid to market presentation of berries by most growers has resulted in the maintenance of satisfactory prices.

NUT INDUSTRY TRENDS

Pecans

An overseas corporation has levelled and prepared the first 720 acres of 2,000 acres intended for planting to pecan in the Moree district. Some 27,000 trees propagated on the property are ready for planting and a large number of seedlings has been raised for the propagation of trees to be planted in 1972 and 1973. Harvesting and processing equipment is to be imported and installed as the trees come into production. Other landholders have become interested in the establishment of smaller areas now that there is a prospect of processing equipment being available locally.

Macadamia

Considerable interest is being shown by the nut industry within Australia and from overseas, particularly from California, in expanding the macadamia nut industry. Present plantings exceeding 300 acres include one planting of over 200 acres on the Richmond River. The recent plantings are all grafted varieties of N.S.W., Queensland or Hawaiian origin and are confined to the Richmond-Brunswick-Tweed areas. If all projected plantings are undertaken, the total area could exceed 2,000 acres within five years. Most large scale enterprises are integrating a nursery into their projects to overcome problems in supply of trees, and to reduce costs. The outlook for the industry is bright. Present domestic consumption is estimated at about 4 nut kernels per person per annum and could increase if supplies were available. Further expansion in Hawaii is reported to be unlikely, and development is relatively slow in California. The main area of expansion overseas is in South Africa which, with its favourable climate, may produce appreciable quantities in the future. The Australian trade has had sufficient enquiry from overseas to indicate that a favourable export market can be developed readily in Europe and that the United Kingdom at present is unable to secure supplies of processed macadamia nuts.

TROPICAL FRUIT INDUSTRY TRENDS

Seasonal Conditions

In general, seasonal conditions were good with summer temperatures milder, and rainfall higher, than average. The weather was exceptionally dry from June to August in all tropical fruit districts. A succession of frosts in July aggravated the position and plant health deteriorated seriously in some soil types. From the end of September the position improved steadily. Rainfall was adequate for growth in all areas and, as temperatures rose, bananas and tree fruits responded well. In the far north, record falls of over 20 inches were recorded in December and rainfall was above average in the following months. However it was below average in all districts during April and May and growth

rate began to decline earlier than usual. In June, very useful rain fell in the Coffs Harbour and Nambucca districts, with lighter falls in the north. Storm damage was isolated. Local hailstorms caused some damage. Cyclone damage was light although wind damage occurred in the Tweed and Brunswick districts.

Banana Production and Plantings

The state acreage of bananas continued to decline but the decline in 1969-70 and 1970-71 was considerably slower than in 1968-69. The net decline between 1970 and 1971 amounted to 426; the area of uneconomic plantations destroyed was greater than the area of new plantings.

Estimated production for the year was 3,950,000 bushels, very slightly above that for the previous year. Productivity was maintained at an estimated 177 bushels per acre.

The table indicates the trends in banana acreage, production and productivity for the period 1968-71.

	Area (Acres)	Production (bushels)	Productivity (bush/acre)
1967-68	23,815	4,750,000	195
1968-69	22,842	3,597,000	157
1969-70	22,540	3,900,000	173
1970-71	22,114	3,950,000*	177*

* Estimate only

Banana Marketing

Domestic markets. — The N.S.W. industry is concerned at the strong competition from North Queensland bananas on the southern markets which have traditionally been shared with Southern Queensland growers only. North Queensland bananas now contribute more than 1,000,000 packages to the southern markets and Western Australian outlets during the period April to November. This has had the effect of lowering the average return to all growers, but is felt more acutely by the southern growers whose productivity is lower than those in North Queensland.

Export markets. — There was strong enquiry from Japanese interests about the establishment of an export trade in bananas. Japanese quarantine authorities have relaxed requirements for commodity treatment previously required for fruit fly control, and now permit entry of banana fruits in a hard green condition. Small trial shipments were forwarded by sea but the maturity and appearance did not meet the importers' requirements because of shipping delays and limitations on the use of post-harvest fungicides. The trials are continuing in collaboration with the Banana Growers' Federation Co-op. Ltd.

The present system of fruit handling in N.S.W. is not suited to contracts for large scale export. Without central packing houses to control output and quality it seems doubtful whether N.S.W. can participate in an export trade with Japan at the time of year for which it is sought.

Aerial Spraying of Bananas

Aerial application of fungicides and misting oil for the control of Sigatoka leaf spot disease in bananas continued to increase. The 5,403 acres sprayed from the air in N.S.W. in 1970-71 was almost 700 acres more than the previous year and represented 24 per cent of all bananas. The substantial increase of 900 acres aerially sprayed in the northern areas was a direct result of successful control obtained in the previous year and the operation of additional aircraft there. The acreage sprayed in the southern areas declined due to problems with aircraft.

Banana Weevil Borer

Resistance of banana weevil borer to dieldrin was confirmed in confined pockets in the Brunswick River banana areas in 1968. Since then, resistant strains have been found in most of the Brunswick district and in two plantations in the Tweed district. This indicates a gradual development of resistance over a wider area and specimens are being sought from the Tweed and Richmond districts so that the full extent of the problem can be determined. The resistance problem is receiving high priority attention by the Entomology Branch which has located an Entomologist at the Tropical Fruit Research Station.

Avocados

The avocado acreage increased by 113, bringing the state total of 287 acres, of which 84 per cent are non-bearing. Most of the extension has taken place in the Brunswick and Richmond River areas. The varieties Fuerte, Hass, Sharwil, Edranol and Zutano have been preferred. Some exploratory planting is being made in the Lower Murray area. The rapid development of the industry is the result of several factors, including the need for banana growers to find alternative uses for land, a growing demand for avocados due partly to promotion by Queensland growers, and local and overseas interest in large scale development. A number of large plantings are projected for the Richmond-Brunswick-Tweed areas. Immediate further expansion will be limited by the scarcity of suitable, well-drained land, restricted supplies of grafted varieties (or seed and scion wood) and the high costs of establishing and maintaining trees to bearing age. It is unlikely that avocado supplies will meet demand in the foreseeable future.

Passionfruit

The acreage of passionfruit fluctuates widely from year to year, because it is a relatively short-lived crop; it is often grown as a cash crop while a more permanent enterprise is being established; obtaining firm contracts with processors can be difficult due to competition from imported juice and pulp; and it has limited potential as a fresh fruit. The present acreage in N.S.W. of 548 acres, with Queensland production, appears to be adequate in view of fairly substantial imports of pulp from New Guinea and Fiji. Hybrid varieties have improved productivity of plantings in northern N.S.W. and propagation of scions on disease resistant rootstocks has increased the life expectancy.

Pineapples

This crop is of minor importance in N.S.W. and has rarely exceeded 300 acres. The N.S.W. crop is in direct competition with production from larger areas in Queensland and there is now no processing outlet in this State. The cannery at Ballina closed in 1969. The problems included lack of continuity of supply and lack of support from growers. The market for fresh fruit, though not lucrative, absorbs N.S.W. production at a payable price to the grower. It is unlikely that the pineapple industry will expand beyond its present level without a processing plant. Proposals for the provision of a plant are being examined by processors.

VITICULTURAL INDUSTRY TRENDS

Seasonal Conditions

The 1970 winter was extremely dry in N.S.W. viticultural districts. The Hunter Valley had significant rain for five consecutive months. Heavy rain during August and September relieved the dry conditions and promoted vigorous early vine growth. Continuing rain during the remainder of the growing season, particularly during the December to February period in the Campbelltown, Hunter Valley, Mudgee and Orange districts made control of fungal diseases difficult and split ripening fruit. It also caused flood damage in some Hunter Valley vineyards.

In the inland irrigation districts on the Murrumbidgee and Murray Rivers, rain during February caused crop losses and seriously hindered fruit drying in the Murray River districts. Frosts in the latter half of October caused extensive damage in the MIA and lesser damage in Murray River districts. Cool weather during the November flowering period also appeared to have an adverse effect on berry set of sultanas in Murray River districts.

Vines in small sections of the Lower Murray, Hunter Valley and Sydney districts were severely damaged by hail. Minor scattered hail damage occurred in other districts.

Wine Grape Production

The trend of increasing production of wine grapes in N.S.W. since 1962 was halted in 1971. The quantity of grapes processed by wineries in N.S.W. fell from the record 70,981 tons crushed in 1970 to an estimated 53,000 tons. The fall in production was directly related to the light crop harvested in the Murrumbidgee and Coleambally Irrigation Areas. Despite an increase in bearing acreage in these areas, only 38,596 tons were produced, compared with the record crop of 53,887 tons in 1970. The fall in average yield per acre from 8.9 tons in 1970 to 5.9 tons was attributed to spring frost damage, rain damage before harvest and the debilitating effect of the previous season's heavy crop on vine health.

Price negotiations between the N.S.W. Wine Grapes Marketing Board and the MIA Winemakers' Association before vintage were protracted, despite the relatively small crop. They foreshadowed difficulties in wine grape marketing in future years when production is expected to reach 66,000 tons by 1973 if yields are normal.

In the Hunter Valley, the potentially large crop was affected by torrential rain in mid-summer. The average yield was reduced to one ton per acre. Vintage was estimated at 1,500 tons. The wet, cool conditions delayed fruit maturity and, in conjunction with the early picking necessitated by the danger of total loss of the crop through bunch rot, detracted from the quality of wine made.

There was a strong demand for sultana grapes and large quantities were diverted to Murray River wineries. Yields of Murray River wine grape varieties were also good with newly-planted areas of Cabernet Sauvignon producing their first crop.

Production of grapes used for wine in Australia increased from 224,879 tons in 1965 to 351,491 tons in 1970 and is expected under normal seasonal conditions to exceed 400,000 tons by vintage 1974.

Consumption of Wine

Consumption of wine in Australia increased from 13,845,000 gallons in 1964–65 to 24.4 million gallons in 1969–70. Per capita consumption increased from 1.25 to 1.95 gallons. These increases can be attributed almost entirely to gains in the consumption of still and sparkling wines; per capita consumption of fortified wines remained static. Brandy consumption in Australia increased from 1,033,000 proof gallons in 1964–65 to 1,495,000 proof gallons in 1969–70.

Although official statistics are not yet available, it is apparent that the upward trend in wine consumption in Australia has stopped; it is estimated that wine consumption fell by some 2,000,000 gallons to 22,000,000 gallons during 1970–71. The decline coincides with the imposition of 50 cents per gallon Commonwealth excise tax on wine.

Exports of wine have declined from 1,998,350 gallons in 1964–65 to 1,322,189 gallons in 1969–70. Only 4.8 per cent of beverage wine produced in Australia is now sold on export markets.

Prices for Wine Grapes

Boom conditions resulted in very high prices for wine grapes from quality districts. In the Hunter Valley, prices of up to \$450 per ton were paid in 1970–71. In the MIA, prices ranged from \$53 to \$125 per ton depending on variety; an increase of \$1 to \$3 per ton over prices paid in 1970.

Wine Grape Plantings

The area of wine grapes in N.S.W. doubled from 8,502 acres in 1965 to 15,628 acres in 1970, encouraged by rapidly increasing domestic sales of wine. The boom in the wine industry has encouraged an influx of newcomers to invest in vineyards and wineries. Many large new vineyards have been started by city investors. Most of these are in the Hunter Valley because of its reputation for high quality wine, proximity to Sydney, and the relative lack of restrictions on vineyard size. Hunter Valley plantings of wine grapes now total 5,102 acres, an increase of 3,778 since 1965. It is anticipated that an additional 2,000 acres will be planted in 1971 and that the total area planted will reach 10,000 acres by 1975.

Extensive new plantings of wine grapes have also been made in the MIA, often at the expense of other, less economic horticultural plantings. Plantings in the Murrumbidgee and Coleambally Irrigation Areas increased from 5,572 acres in 1965 to 8,066 acres in 1970. Planting of wine grapes during 1971 in the MIA is expected to be greatly reduced because of the likelihood of over-production of wine grapes in the near future. The 1971 annual meeting of the MIA Wine Grape Planting Advisory Committee recommended that a "severe brake" should be placed on the further expansion of wine grape plantings and that only a limited quantity of premium wine varieties be planted.

There has been a major change in ownership of the Australian wine industry in the past three years. The majority of wine businesses previously owned by proprietary or family companies have now been taken over by large public companies, many owned overseas. The greater financial reserves of these companies and their more varied expertise, particularly in marketing, are expected to cause marked changes in the organization and operation of the Australian wine industry.

Dried Vine Fruits

Dried vine fruit production in N.S.W. for 1970–71 was estimated at 9,031 tons dried weight, compared with the record crop of 14,769 tons in 1969–70. The 1968–69 crop was also light. The estimated production for 1971 comprised 7,365 tons of sultanas, 1,064 tons of raisins and 602 tons of currants. Production of raisins and currants was well above normal. However sultana production was only slightly more than half that of 1970, due to low crop potential following last season's heavy crop, berry splitting and mildew development as a result of rain and poor drying conditions.

Only 66 acres of dried vine fruit varieties were planted in N.S.W. during 1970, bringing the total area planted to 9,740 acres. The low rate of expansion reflects the marketing difficulties of the industry.

Abandonment of the International Sultana (Raisin) Agreement has disrupted the orderly marketing of the world's dried vine fruit crop and led to heavy price-cutting. This has seriously affected the marketing of the Australian dried fruit crop, 75 per cent of which is exported. Reductions in export prices of up to \$60 per ton have been necessary to ensure the sale of Australian fruit. The average return to growers is expected to fall to \$230 per ton, \$43 below average cost of production. At this price level, many growers will be in severe financial difficulty. The entry of the United Kingdom into the EEC is expected to further reduce returns to growers. A new stabilisation plan for the dried vine fruits industry backed by the Commonwealth Government was announced in June, 1971. The plan, yet to be accepted by a referendum of growers, would operate for five seasons commencing with the 1971 season.

Substantial increases in the production of dried vine fruit varieties, particularly sultana, and even greater marketing difficulties, seem inevitable in the future. The increases in production will result from large new plantings of dried vine fruit varieties in other states in the last three years, extensive use of high yielding clones, and improved trellising and irrigation practices.

Table Grapes

Table grape production in N.S.W. declined in 1970-71 as a result of the unfavourable season and strong demand by wineries for grapes. Australian production of table grapes rose from 25,000 tons in 1965 to 29,749 tons in 1970. N.S.W. production has been relatively static with 8,568 tons being produced in 1969-70 from 2,689 acres.

In the Campbelltown district, early prospects for a good harvest of quality fruit in 1971 were circumvented by heavy rain and hail storms during January and February. Quality of bunches was severely affected in many instances. Growers who used extensive bunch trimming to prepare fruit for market were able to obtain satisfactory prices but for only 30 to 50 per cent of a normal crop. Production of table grapes in the Hunter Valley was also adversely affected by rain, although early maturing fruit was less affected and gave good returns. Good prices were also obtained for grapes from the central tablelands, but production was reduced by spring frosts and rain damage. Late maturity of sultanas in the Lower Murray district delayed marketing until mid January and rain damage in most areas curtailed shipments to market after February.

A total of 82,875 half bushel cases of table grapes were marketed from the MIA compared with 113,239 cases in 1969-70. It is anticipated that this declining trend in MIA table grape production will continue while winery demand for grapes remains strong.

Plantings of table grape varieties in Australia are declining slowly but production continues to rise largely through diversion of the dual purpose varieties sultana and Waltham Cross from drying to the fresh fruit market.

Consumption of table grapes is expected to rise steadily with increases in population. This expanding market will be largely catered for by diversion of the dual purpose varieties to the table market. Demand for quality fruit is strong and further plantings of Black Muscat in particular appear warranted.

Helicopter Spraying of Vineyards

Spraying of vineyards in the Pokolbin area by helicopter for the control of downy mildew, other fungus diseases and insect pests, was commercially successful in 1970-71. One small and three large vineyards were sprayed by helicopter throughout the season with outstanding results. Many other vineyards applied sprays by helicopter when wet ground prevented conventional ground spraying. Helicopter application had the advantages of rapid coverage and not being limited by wet ground. The cost was competitive with that of ground spraying. Following the successful trial in last season's adverse climatic conditions, it is anticipated that over 1,000 acres of vineyards in the Hunter Valley will be sprayed regularly by helicopter next season.



Helicopter spraying of vineyards for the control of downy mildew, other fungus diseases and insect pests was commercially successful in the Pokolbin area. Helicopters cover the vineyards quickly and can be used when wet soil prevents ground spraying. Wider use of helicopters is expected in the future.

Drying of Sultanas

At the beginning of the season growers in the Murray River districts favoured dipping as a method of promoting fruit drying but most of them turned to the newly-developed rack spraying technique when drying conditions became difficult.

These difficulties also generated considerable interest in a new drying technique in which the fruit is dried on the vine. Over 150 acres of sultanas were dried on the vine in the Sunraysia area during the 1971 harvest. The technique involves cutting fruit bearing canes at fruit maturity, spraying the whole vine with dipping solution and allowing the fruit to dry on the vine before harvest. It was found particularly useful in salvaging rain damaged fruit; one grower was able to save 16 acres of fruit in this way.

Fruit drying on the vine is relatively resistant to rain damage. It is possible to prepare a large area of fruit for drying rapidly so the technique also minimises labour required at harvest. Vine-dried fruit, while being darker than rack-dried, has the advantages of being relatively free from grit and more easily harvested by either hand or machine.

REGULATORY SERVICES

LEGISLATION

Plant Diseases Act

Important amendments to the Plant Diseases Act are expected to be tabled in Parliament early in the 1971–72 financial year. These include new provisions for dealing with market offences and with the retail sale of fruit and vegetables, changes in definitions of pests, diseases and plants and changes in the procedures for requiring control measures to be implemented.

Regulations and proclamations issued during the year under the Act were: (a) amendment to the proclamation prohibiting entry of fruit, plants, rice, etc., into the Murrumbidgee Irrigation Areas; (b) declaring *Chaenomeles* sp. to be a plant; (c) restrictions on the entry of stone fruits and plants from Victoria because of the presence of *Sclerotinia laxa*; and (d) amendment to Regulation 59, prescribing signs for quarantine road blocks.

Matters under consideration for the issue of new proclamations include: (a) extension of the MIA quarantine boundaries to include Coleambally Irrigation Area; (b) extension of the rice quarantine area to include Murray Valley rice areas; and (c) creation of a new quarantine area in the Lower Murray Valley to consolidate a number of existing restrictions.

Fruit Cases Act

Further action on the new Fruit and Vegetable Marketing and Packaging Act which will replace the outmoded Fruit Cases Act, and will include the fruit and vegetable grading and packaging powers contained in the Plant Diseases Act, is awaiting the amendments proposed for the latter Act.

Horticultural Stock and Nurseries Act

The draft regulations have been prepared, considered by industry, and accepted. Action will now proceed for their gazettal.

Banana Industry Act

A committee, comprising the Board of the Banana Growers' Federation, a consumer representative and a representative of the Department, has been established under this Act. Any restrictions or directions proposed by this committee must, if challenged, meet with the approval of a majority of growers. This is the first substantial step in the direction of orderly marketing of bananas in N.S.W. and should result in benefits to the industry.

Potato Growers' Licensing Act

The number of licences issued during the year was 1,152 compared with 1,058 in the previous year. A request was received from industry for the provisions of this Act to be extended to provide for the licensing of all who grow potatoes for sale.

PROSECUTIONS AND WARNINGS

Prosecution proceedings were initiated in respect to the following offences: *Market Offences* — failure to remove old brands from packages, 6; failure to brand packages, 9; forwarding processing grade tomatoes to other than a processor, 1; topping, 1; making a false statement to an Inspector, 2; hindering or impeding an Inspector, 1; refusing to state name and place of abode, 1; *Pest and Disease* — failure to control fruit fly, 3; failure to comply with a notice, 2; failure to keep bananas free from weeds, 1; breach of MIA quarantine, 8.

In addition, 42 consignments of immature grapes totalling 1,292 cases were seized and destroyed, and letters of warning were sent to 6 persons for market offences.

FRUIT FLY CAMPAIGN

The past season was one of the worst for many years for fruit fly. Not only was the level of infestation higher than normal in areas where infestation usually occurs, but outbreaks were recorded in many areas which are normally free of this pest.

Town treatment programmes, involving varying numbers of bait sprays of maldison plus protein hydrolysate, were applied to 46 towns; 14 of the towns were apparently free from infestation, 20 experienced light infestation while 12 had moderate to heavy infestation late in the season. While results were not as satisfactory as normally achieved, the treatments did suppress infestations. Frequent and heavy rain at critical periods was largely responsible for the decline in efficiency.

Interceptions of infested fruit at the Euston Road Block totalled 89 compared with 44 in each of the previous two years. In all, 687,204 vehicles were examined and 29,393 contained fruit.

The occurrence of fruit fly in and adjacent to the Murrumbidgee Irrigation Areas, and in Victoria in the mid-Murray Valley districts, has placed restrictions on the export of citrus from these areas to New Zealand. While New Zealand quarantine authorities will permit the entry of post-harvest treated fruit, the additional cost of treatment plus the reluctance of the buyer to purchase treated fruit will result in reduced returns and a marked decline in the volume of exports to New Zealand from the affected areas.

PEST AND DISEASE INCIDENCE

Stone and Berry Fruits

Heavy losses from *brown rot* occurred in weather damaged fruit in some areas and post-harvest development of the disease depressed prices in the markets during damp weather. However losses were not as extensive as might have been expected. It is believed that more attention to orchard sanitation by many orchardists, and the use of the recently released fungicide benomyl, had a marked influence on the level of brown rot. The incidence of fresh infections of *bacterial canker* was much lower than in previous years but this disease continues to seriously affect the establishment of new cherry plantings, particularly in the Orange district. Weather was favourable for the development of *bacterial leaf spot* which occurred in a number of coastal and tableland peach and plum orchards.

There were fewer reports of *San José scale* infestations than in previous years. *Queensland fruit fly* was very active and special action was necessary for control in a number of inland areas where the pest is not normally troublesome. Reports of damage from *Carpophilus beetle* continued to come from coastal areas; an increased incidence in recent years is thought to be associated with the trend to harvest fruit in a more mature state for packing in single layer trays.

Providing virus-free planting material and encouraging strawberry growers to use it has been highly successful. There was little observable *virus infection* in areas planted. Due to wet summer conditions, *leaf spot* and other common diseases were more prevalent than normal.

Viticulture

Wet, humid conditions were ideal for the development of *downy mildew* in most districts but, where adequate precautions were taken, damage and crop loss were minimal. Dithianon was widely accepted as a means of control, but some growers using this chemical developed allergic skin reactions. A few vines in the Hunter Valley showed symptoms of the serious *dying arm* disease (cause unknown) early in the season but, unlike the dying arm disease known in South Australia, the vines grew out of these symptoms as the season progressed. Vines displaying the classical symptoms of dying arm have yet to be found in N.S.W. although other diseases, such as *black measles* which could be closely related to dying arm, have been prevalent in N.S.W. vineyards. The fungal disease *dead arm* was observed in vineyards where control sprays of sodium arsenite had not been applied. In some cases it severely reduced the crop.

Bunch rot, promoted by heavy pre-harvest rains and berry splitting, caused severe crop losses in most districts. In the Lower Murray district, sprays of benomyl were successful in controlling *Botrytis* in sultana bunches, but were ineffective against *Rhizopus* rots. Extensive use was also made of sodium sulphite in dips and sulphuring of racks to control mould development in drying fruit. In the Hunter Valley, many grape growers were forced to pick immature fruit to avoid total crop loss through bunch rot infection. In coastal table grape growing districts, extensive trimming of table grape bunches was necessary to prepare the fruit for market.

Leaf roll is regarded as the most serious virus disease infecting N.S.W. vineyards and is known to reduce yield and fruit quality. It is now suspected as being the prime cause of poor fruit quality in the table grape varieties Black Muscat and Cornichon. In some districts, it was difficult to convince growers of the need for careful selection of planting material to avoid planting leaf roll infected vines which may have low yield and fruit quality potential.

Elephant beetle and *vine moth caterpillar* caused moderate damage in a number of Hunter Valley vineyards. Damage from insect pests in other districts was only minor.

Bananas

The number of *bunchy top* infected plants detected increased by 620 to 1,125; 76 per cent of the total detections occurred in the Tweed, 22 per cent in the Brunswick and only 2 per cent in the Richmond district. The southern areas of Coffs Harbour and Nambucca remained free of the disease. The encouraging position in the Richmond district led to a reorganisation of the pattern of inspections and redeployment of bunchy top detection staff. An additional gang was added to the Tweed district strength to allow a quicker and closer inspection service.

Very heavy infections of *Sigatoka leaf spot* and *leaf speckle* in unsprayed plantations during the autumn of 1970 resulted in defoliation of bunch bearing plants from June to November that year. A similar situation existed again in 1971 when protracted rainy periods during December to May prevented a full control schedule being applied. Under these circumstances, fruit quality is seriously affected during the late winter to mid summer period, with a large proportion of bananas marketed being thin, unattractive and subject to post-harvest breakdown.

Corky scab is still responsible for wastage and downgrading of a significant proportion of fruit maturing in the autumn from bunches that emerged in December and January. Although plantations in the Tweed and Brunswick were affected quite heavily with *Marasmiellus* (white fungus) during the late winter and early spring months when conditions were extremely dry, the infection slowed down and virtually ceased when plants became more vigorous after good rains in the summer and the 1971 autumn.

Market reports indicated an increase in the incidence of both *squirter* and *blackend* diseases. There is evidence that many growers are failing to treat bananas for market with a fungicide, although good control of the diseases is possible if either TBZ or benomyl is used at 200 ppm as a dip or spray treatment.

The appearance of a dieldrin-resistant strain of *banana weevil borer* in the Tweed district following resistance in the Brunswick district is a serious problem for banana growers in the north. The industry made approaches for financial assistance for growers in need of rehabilitation. In the southern banana areas the industry-assisted programme to contain and control dieldrin-susceptible weevil borer was continued. Many new infestations were located. Moderate infestations of *red spider* occurred in all areas but were largely confined to leaves. Good control was obtained with demeton-s-methyl and tetradifon.

Other Tropical Fruits

Root rot disease took its toll of avocado trees during the high-rainfall summer period from December to March. The early maturing avocado varieties Fuerte and Rincon were severely infected with *anthracnose* during the wet autumn and losses on the tree and from post-harvest rots occurred. *Monolepta australis* was not as prevalent as usual, but caused damage to avocado fruit and foliage during the dry period in the late spring. However, wet conditions in the autumn when the pest is normally most active prevented serious losses of maturing crop. *Queensland fruit fly* was very active during the mid-summer and late autumn, particularly on thin skinned avocado varieties such as Rincon. Good control was achieved with splash baits of maldison and protein hydrolysate.

Brown spot and *Septoria spot* were both active on passionfruit vines and fruit and caused losses of fruit. Control was difficult due to wet weather. *Phytophthora parasitica* was troublesome in young vines and newly grafted plants, and during the prolonged wet weather severe leaf infections occurred on mature vines causing defoliation and contributing to rapid death of vines. *Queensland fruit fly* was very active and freely stung mature and developing passionfruit resulting in some consignments being dumped. Larvae were found in pulp of hybrid fruits which is most unusual.

An extremely heavy development of *anthracnose* on mangoes resulted in almost a complete loss of crop in all areas. *Leaf miner* and *twig girdler moth* were both active in macadamia plantings but good control resulted from cover sprays of azinphos methyl in most orchards.

Pome Fruits

Prolonged wet periods during the spring and early summer in tableland and coastal highland districts made control of *apple and pear scab* difficult. There will now be a heavier carryover of these diseases in many orchards, and the difficulty of controlling scab in the spring of 1971 could be increased. *Powdery mildew* of apple was prevalent in practically all districts and reports indicate that it was more severe than in recent years; its prevalence may be associated with the much lighter level of pruning now practised. *Sooty blotch*, usually not of great importance, was an economic problem and troublesome to many orchardists in the Campbelltown and Windsor districts. Its incidence was associated with prolonged damp conditions during part of the year. Granny Smith, as usual, was the variety mainly affected. Contrary to most years, the disease was also troublesome with Delicious and Jonathan.

Two-spotted mite which was responsible for considerable tree damage in most districts continues to be a problem nearly every season. Trials that demonstrated that the chemicals available, applied with at least some automatic spray machines, can give effective control are reported under the heading "Research — Pome Fruit Industries". *San Jose' scale* is important in the New England district and the MIA. A requirement that export fruit be free from any San Jose' scale infestation adds to its importance on the MIA. In the New England district, a recent survey indicated that the pest is present in a majority of orchards. The Department recommended a change in emphasis in timing of oil sprays.

Citrus

Better control of *red scale* on citrus was reported on the MIA, probably because spray programmes were timed correctly. A late build up of scale was reported on the Lower Murray. Export rejections due to red scale occurred in both districts. Victorian regulations which restricted the movement of some citrus from the Lower Murray to Melbourne processors have been relaxed

provided the fruit is covered and travels direct to the processor who has agreed to receive it. *White wax scale* was a problem in most coastal districts because adverse weather prevented correct timing of sprays. *Hard wax scale*, which requires separate control measures, was reported as spreading in the Windsor-Parramatta district.

The wet summer did not favour development of *black spot* disease of Valencias in the Gosford district. Control was also aided by dry weather permitting the correct timing of control sprays in October–November. Hawkesbury districts usually harvest early to avoid black spot.

An increasing number of Hawkesbury River citrus growers are cutting costs by reducing citrus spray schedules and supplying fruit for processing only. Their reasons are that market returns are low and the diseases *lemon scab* and *melanose* affect the external appearance but not the internal quality of the fruit. Ultimately, these practices will have an adverse effect on productivity and tree health.

SYDNEY MARKET INSPECTIONS

Fruit – Quality and Supplies

Apples. – Apples were heavily supplied and on offer all the year. CA stored apples lasted until commencement of the new season's crop. Quality was mostly good with very little demand for poor lines. The results of over-maturity at harvest were evident in many packs marketed in June to October. Choice, well-packed large apples met a strong demand, but hail-damaged and small sized fruit were over supplied. Presentation was improved by more extensive use of fibreboard cartons, although there was some underpacking. Light supplies of local early apples were marketed prior to heavy supplies of Queensland Gravenstein and Jonathan. Quality and presentation of the Queensland fruit was very good and local growers had difficulty in competing for the selective demand.

Pears. – Choice large pears met a strong demand on a moderate to heavily supplied market. Hail-damaged, small inferior pears were in heavy supply with a very low demand.

Cherries. – Cherries commenced in mid-November from Young and Orange, with Victorian cherries starting during early December. The state-wide, heavy rains in both October and November badly damaged the Young and Orange fruit which arrived at the market partially broken down with a high percentage of fruit splitting and rain damage.

Apricots. – Early consignment of apricots from the Kurrajong district arrived during the first week of November. These were sound and of fair quality, but lacking in size. Heavy rain during the month saw later consignments rain damaged, cracked and brown rot infected. Some consignments from the MIA arrived showing breakdown and rot.

Peaches. – Early peaches were rain damaged following excessive rain in coastal growing areas, with rots and breakdown evident in most lines, especially Spinks, Watts and Starking Delicious. Throughout the season prices were generally low owing to poor quality, although well presented choice fruit met a strong demand at high prices.

Plums. – As with other coastal stone fruits, plums were weather damaged. Early supplies were heavy and the market glutted. Santa Rosa, Mariposa, and Narrabeen were slow to sell and many were castaway during the season.

Nectarines. – Like other stone fruits nectarines were wasty and weather damaged. Large quantities were castaway throughout the season. Nectarines from Queensland were of reasonable quality and sold well.

Grapes. – Early supplies of Queensland grapes were generally of fair to good quality. Murray River and MIA grapes were only of fair quality due to adverse conditions at the time of the main harvest; coastal growers met similar conditions. Packs of quality grapes met very strong demand. Maturity testing was intensive and, although an improvement of the previous year, approximately 1,292 half bushel cases were destroyed under supervision for immaturity. Many growers lost consignments through breakdown and decay.

Oranges. – During the period June to October, 1970, navel oranges were in heavy to moderate supply. Quality and presentation were good with increasing buyer resistance to small and inferior fruits. Presentation further improved with the extensive use of fibreboard cartons. Maturity and juice content tests of navels and Valencias were continuous with very little regulatory action being necessary. Moderate to heavy supplies of Valencias continued throughout the season. In 1971 Queensland navels, together with MIA and Murray Valley and coastal fruit, created a reasonable supply for which a selective demand existed. Prices overall were low.

Lemons. — Heavy supplies during the main crop met a steady demand. Quality was fair to good, but presentation could be improved. Meyer lemons from Queensland showed some breakdown.

Mandarins. — Good supplies from Queensland of well presented quality fruit met a strong demand. Murray River and MIA mandarins were well supplied and presentation showed improvement. However small and inferior packs, mainly from coastal growers, met buyer resistance.

Grapefruit. — Queensland and Murray River growers provided most of the moderate supplies of grapefruit received. Waste was evident in some lines. Imported fruit from U.S.A. and Israel were used to bridge the gap between crops, but demand was weak for imported fruit, and breakdown was extensive. Presentation and quality from most districts was good.

Bananas. — Supplies of bananas to the Sydney Markets were good although N.S.W. supplies were lower than usual in the spring due to adverse weather. Queensland supplies were heavier than normal during the summer. Quality during the year varied. Drought in N.S.W. resulted in poor filling of the fruit. There were cyclones and floods in North Queensland and growers consigned fruit which had apparently been blown down and covered with flood waters. It arrived in unsaleable condition. Several lines of fruit arrived in a boiled condition due to extreme heat during transport in the summer.

Pineapples. — There were heavy supplies of generally excellent pineapples, mainly from Queensland. There was some increase in supplies from the north coast of N.S.W. A weak market for much of the year made clearance difficult at times but losses were not heavy.

Avocados. — Excellent quality fruit from South Queensland and the north coast of N.S.W. commenced with Queensland Fuerte in late April and ended with Hass from N.S.W. in September.

Custard Apples. — Moderate supplies of good quality fruit were mainly from South Queensland. The season commenced in late April and early May. There were no periods of glut and losses were very light.

Papaws. — Moderate supplies of good quality fruit were received.

Mangoes. — Moderate supplies of good quality fruit, mainly from North Queensland, commenced very early in August and continued until early February. Almost all growers used cartons, many as single layer trays and presentation improved greatly. However size and grading continued to be a problem and some early lines brought complaints about maturity.

Passionfruit. — The moderate supplies were of good quality.

Strawberries. — With the development of improved varieties in the past few years, and increasing imports from New Zealand, strawberries are available the year round. Due to the assured supply of good quality fruit, demand has grown. While supplies were very heavy at times, good prices were received on most occasions with very few losses. Odd reports of topping late in the season required some regulatory action. The practice was not widespread.

Vegetables — Quality and Supplies

Tomatoes. — Tomato supplies were generally moderate. Quality was quite good. But a weak market made clearance difficult on many occasions. Winter and spring crops from Queensland and the N.S.W. north coast kept the market supplied, followed by the local glasshouse crops which become less significant each year. Late spring and summer supplies were mainly from the near metropolitan area — from the Liverpool district, then the Hills area and finally the central coast as summer progressed. Large volumes of South Australian fruit supplemented these areas during late summer and autumn. Quality was good and regulatory action was usually for breaches such as poor sizing or faulty labelling.

Potatoes. — Moderate to heavy supplies of fair to good quality potatoes reached the market during the year with an increase of approximately 400,000 bags on the previous year. Tasmanian supplies were lighter because of blight. Regulatory action was necessary following the detection of powdery scab disease in potatoes from Queensland; about 2,000 bags were either returned to Queensland or processed under supervision.

Lettuce. — Lettuce supplies were fairly heavy for most of the year. Quality was generally excellent. During the heavy rain in early 1971 agents found it profitable to import lettuce from as far afield as South Australia. Presentation improved with the use of printed cartons.

Cucumbers. — Supplies of cucumbers were heavy for most of the year. Fruit from Queensland in winter and spring was followed by green cucumbers from local growers and then by apple varieties as the weather cooled. Quality was excellent, except for some over-matured fruit from Queensland.

Carrots — Moderate supplies of bagged carrots were received throughout the year. Quality was very good. The few losses were incurred by MIA growers who persisted with plastic bags in very hot weather. They caused severe sweating.

Parsnips — Supplies were moderate and of good quality. As with carrots, some losses were caused by the use of plastic bags.

Swede Turnips — Moderate supplies of excellent swedes were received. Very few losses were incurred.

Sweet Potatoes — There were good quantities of excellent quality tubers for most of the year. Heavy rain caused some losses to north coast growers. The widespread use of cartons for packing has improved the presentation of sweet potato packs.

Pumpkins — Supplies were heavy and of excellent quality, with very few losses. The Butternut variety has become very popular and was heavily supplied.

Peas — For most of the year the market found difficulty in clearing the moderate supplies received, possibly due to competition from processed lines and to the planting of canning varieties for the fresh pea market.

French Beans — Supplies were heavy, except during the period of rain in January. There was extreme difficulty in clearing the market.

Capsicums — Heavy supplies of good quality capsicums came from Queensland in the winter and early spring and from the near metropolitan areas in late spring and summer. Some heavy losses were experienced by Queensland growers who persisted with supplies into the hotter weather.

Zucchini — The very heavy supplies were of excellent quality. Queensland is still the major source for winter and early spring followed by increasing supplies from the central coast and metropolitan growers.

FREEDOM FROM DISEASE CERTIFICATES

Freedom from Disease Certificates for exports to other states were issued as follows: plants — 997 plants; vegetables — 8,501 packages; and fruit — 1,553 packages.

EXPORT INSPECTIONS

Fresh fruit and vegetables, seeds, wheat, flour, etc., submitted for export were examined on behalf of the Commonwealth Department of Primary Industry under provision of the Commerce (Trade Descriptions) Act.

Containerisation has brought about changes in export inspection. To facilitate handling, the final inspection of goods exported in containers now takes place when the container is loaded and the inspection place has shifted from shipside to various country centres. Goods involved include fruit, vegetables, grain, flour and seeds. Because the place of loading is frequently distant from the headquarters of the Inspector the cost and time involved in carrying out inspections is far greater than with conventional shipping.

Permits Issued

1,742 export permits were issued for fruit; 2,286 for vegetables; 593 for flour; 180 for wheat; and 237 for other commodities; a total of 5,038.

In addition, permits were issued for a total of 27,726 packages as follows: pasture seed, 9,804; bird seed, 1,108; field peas, 839; vegetable seed, 13,184; tree seed, 384; nuts, 396; cereal, 1,577; maize, 434.

Fruit and Vegetable Inspections

Apples — The 140,236 bushels (last year 142,665) of apples shipped from the Port of Sydney included 13,196 from Queensland, 11,970 from Tasmania, 110,813 from N.S.W., and 4,257 from South Australia. About half were exported to U.K. and the Continent (13,295 to Germany), with most of the remainder going to South-East Asia and Pacific Island destinations. A small shipment of 1,469 bushels went to Kenya. Rejections totalled 3,471 bushels. The main reasons for rejection were bitter pit, broken skins, bruising, San José scale, and core temperatures exceeding 45°F (where precooling was required for shipment under refrigeration).

Pears — Pear shipments totalled 74,548 cases (previous year 33,169) and included 8,545 cases to the U.S.A. subject to intransit or post-entry sterilization. The main other destinations were South-East Asia and Pacific Islands.

Oranges — 94,548 bushels were exported, an increase of 14,000 on the previous year. Most were shipped to South-East Asia, with 60,305 to Singapore, and a small percentage to the Pacific Islands.

Other Citrus — 1,880 bushels of mandarins were forwarded to destinations similar to those for oranges and 4,019 bushels of lemons and grapefruit went to Pacific Island destinations.

Grapes — An increase of almost 2,000 cases brought total shipments to 16,783 cases (mostly ½ bushel). They mainly went to the Pacific Islands.

Stone Fruits — 50,147 cases, nearly twice as many as the previous year, were forwarded to the Pacific Islands.

Strawberries — Shipments increased by more than threefold to 4,137 cartons for the Pacific Islands.

Tomatoes — 29,683 boxes (an increase of 8,000) went to the Pacific Islands.

Miscellaneous Fruits — A total of 2,145 packages, including many small consignments, were mainly for Asian and Pacific Island destinations.

Vegetables — The 249,426 packages exported was more than double the previous year's shipments. Rejections were fairly heavy due mainly to soil and some insect infestation. The principal items exported were 124,334 bags of onions (73,734 to Japan) and 60,919 bags of potatoes. Apart from Japan, the main outlets were New Caledonia, Fiji, Solomon Islands, New Hebrides, Samoa and New Guinea.

Grain and Flour Inspections

Grain — Wheat and other grain inspections continued regularly throughout the year at Sydney and Newcastle Grain Elevator Terminals. Wheat exports were fractionally higher than in the previous year.

	SYDNEY	NEWCASTLE	TOTAL
Ship surveys	90	62	152
Ships rejected at survey	17	16	33
Bulk wheat (tons) — loaded	1,791,578	793,973	2,585,551
— rejected	11,488	45,858	57,346
Bagged wheat (tons) — loaded	565	1,319	1,874
— rejected	20	Nil	20
Barley (tons) — loaded	3,000	3,646	6,646
(bagged)	(bagged)	(bulk)	
rejected	40	2,000	2,040
(bagged)	(bagged)	(bulk)	
Bulk maize (tons) — loaded	Nil	8,291	8,291
— rejected	Nil	40	40
Bulk sorghum (tons) — loaded	Nil	102,745	102,745
— rejected	Nil	80	80
Bagged oats (tons) — loaded	50	Nil	50
— rejected	Nil	Nil	Nil

Flour. — The 82,036 tons of flour exported was 15,831 tons less than the previous year. There were 373 bags rejected for water damage. Shipping of flour in containers, begun in 1969–70, did not increase much. Flour may be loaded in containers only at approved premises.

Rice. — Rice exports fell by 21,000 tons to 59,910 tons. The destination was mainly New Guinea and Pacific Islands.

General Exports

The 5,916 International Health Certificates issued were an increase of 94 over the previous year. The Certificates covered 185,935 packages, comprising such items as small quantities of seed, nursery stock, cut flowers and small packages of fruit which do not require an export permit; items not a product of Australia; and a number of consignments for which export permits are required.

PLANT QUARANTINE

Intra-State Quarantine

Action has been commenced to extend the rice quarantine area to include all producing areas within N.S.W. Similarly the MIA quarantine area is being extended to include the Coleambally Irrigation Areas. Inspectional strength at Griffith is being reinforced by the appointment of an additional Inspector. Controlled entry of apples into the MIA is now permitted and it is anticipated that, as further acceptable post-harvest sterilization treatments are developed to eradicate any fruit fly infestation, further fruits will be allowed entry. Breaches of MIA quarantine continued to be a problem and prosecution proceedings were initiated for eight offences. Many illegally introduced second-hand boxes were seized.

Reviews of the banana bunchy top and weevil borer control and eradication campaigns were completed and changes introduced. A total of 69 notices was issued in respect to breaches of Regulations 28 and 29 of the Plant Diseases Act concerning control of weeds in banana plantations.

Commonwealth Quarantine

The volume and complexity of inspectional work in respect to overseas imports continues to grow and with changes in Custom's procedures more responsibility has been placed on the plant quarantine services. The number of quarantine permits issued rose from 51,781 last year to 58,760. Assistance continues to be given by the Forestry Commission in the identification of timber pests intercepted, and by the Biological and Chemical Research Institute of this Department with other pests and diseases and for pathological examination of plants in post-entry quarantine.

The Seed Testing Laboratory of the Department's Division of Plant Industry examined 351 samples submitted for detailed examination, of which 65 samples contravened one or several provisions of the Quarantine Act. Within the 65 samples, 57 contained prohibited weed seeds, 53 contained excessive quantities of restricted crop seeds and 23 samples contained excessive quantities of earth. The Laboratory hand-cleaned 77 packets of seed (trade and experimental samples) and hand-cleaned 5 portions of small lots to facilitate release. Identification of 37 suspect specimens extracted from the samples was requested from the Chief Biologist, Chief Entomologist or Chief Botanist.

The average time of test (date of receipt to date of report) was reduced from approximately 17 calendar days for 425 samples in 1969-70 to 11.3 calendar days for the 351 samples in 1970-71.

Nursery stock. — Nursery stock imported was 3,461 plants less than in the previous year. A total of 11,057 plants was held under the Nursery Stock Regulations. They included 5,443 orchids, 1,538 ornamentals, 357 aquatic plants, 1,463 succulents and cacti, 1,061 bulbs and rhizomes, 1,025 rose budding eyes and 170 sugar cane cuttings. Initial inspections revealed little disease or pest except mites, mealy bugs and aphids.

Parcel post — The examination of all goods and articles subject to quarantine arriving through the Parcel Post at the Sydney Mail Exchange continued. A total of 11,297 parcels and packages was withheld by Customs for quarantine examination, of which 2,051 were detained for further examination, treatment or destruction, as the case required.

Overseas passenger vessels — A total of 280 overseas passenger and naval vessels was attended on arrival for inspection of articles brought to attention by Customs Officers. Large quantities of goods were held for treatment or destruction.

Supervision of treatments — Treatments supervised at approved premises included fumigation, heat treatment, destruction, steam cleaning and cleaning of seeds.

Inspection of premises — Inspection of cotton, peanut and copra processing plants and regular inspection of goods at approved premises continued. Cars quarantined for soil contamination were re-inspected at approved commercial importers' premises after steam cleaning.

Customs liaison — An Inspector is assigned to duties in liaison with Customs to expedite the movement and better control over cargo on the wharves. During the year, undelivered goods from 1,094 overseas ships were removed to Bond.

Containers — The number of container vessels arriving regularly at the Port of Sydney increased from 15 to 24. There were 13 from the U.K. and Europe, 8 from Japan, 2 from U.S.A. and 1 from New Zealand. The number of containers landed at the Port of Sydney during the year was 51,197 from container vessels and 17,000 from conventional cargo vessels, an increase of 50 per cent.

Timber — The quantity of timber imported into N.S.W. was 190,500,000 super feet, 3 per cent less than in the previous year. A decrease of 10,000,000 super feet in imports from North America was nearly offset by an increase of 8,000,000 super feet from South-East Asia. The following timbers (in super feet) were quarantined and subjected to treatment: Hemlock — 2,582,000; Meranti, etc. — 2,080,000; Philippine mahogany — 1,584,000; S.E. Asian logs — 1,559,000; Douglas fir — 275,000; Klink pine — 53,000; Ponderosa pine — 42,000; Veneer — 2,000; and Miscellaneous dunnage and billets, etc. — 23,000 — a total of 8,200,000 super feet.

The Hemlock from the U.S.A. was infested with Ambrosia Beetle, Meranti and Philippine mahogany from South-East Asia with borers of the family *Bostrychidae* and *Lyctidae*, and the logs from South-East Asia with *Xyleborus* sp. Carpenter ants were found in dunnage on six ships from U.S.A. ports. If the dunnage was landed from the ship, it was fumigated.

General wharf inspections — A total of 1,014 overseas ships was visited to inspect goods for which a Quarantine Permit is required before release. This was 293 fewer ships than in 1969-70. However many of the new vessels are two to three times the size of their predecessors. Items inspected included coffee, cocoa, copra, dates, legumes, peanuts, other nuts, pasture seed, motor vehicles, all cargo from India, Pakistan and Ceylon, cotton and all rattan and bamboo ware.

A total of 34,289 motor vehicles was imported, an increase of 7,554. Steam cleaning to remove soil was required for 1,431 of the 2,731 second-hand vehicles and 3,422 of the 31,558 new vehicles.

Bean seed (*Phaseolus*) imported for processing and released after treatment totalled 29,119 sacks, an increase of 6,900 sacks. Spillage contaminated much general cargo because bags were weak and cleaning was required under supervision. Imports of unrestricted categories of beans, comprising broad beans and tick beans, totalled 1,332 sacks.

In almost every shipment of soybean meal imported (95,840 sacks) there was considerable spillage because bags broke. Spillage was reduced where bags were on pallets. Insect infestation required 15,790 bags to be fumigated.

Vegetable and fruit imports included 6,535 bags of onions and 29,749 cartons of fresh strawberries from New Zealand and 14,845 cartons of grapefruit from Israel and the U.S.A.

To comply with the Customs (Narcotics) requirements, 675 bags of poppy seed (opium) were identified and devitalized.

Copra imports of 344,459 sacks (23,810 tons) were quarantined and processed under supervision, and the bags heat-treated and 3,990 tons fumigated for heavy insect infestation. There was noticeable improvement in the level of insect infestation in shipments later in the year, following the fumigation of some heavily infested lots.

Shipments of 4,821 tons of soybeans from the U.S.A. for oil extraction and 29,243 bags of peanuts from New Guinea for both oil and confectionery were processed under supervision and 2,754 bags of peanuts were fumigated for insect infestation before release for processing.

Unrestricted nut imports totalled 61,601 packages of walnuts, cashews, almonds and brazil nuts.

Jute waste (1,367 bales) was heat-treated for cereal straw and rice husks contamination.

Of 17,695 sacks of pasture seed, mainly from New Zealand and the U.S.A., 2,298 were cleaned of foreign seeds and released and 44 sacks of ryegrass, after unsuccessful recleaning, were returned to the country of origin. There were 114 bags of herbs cleaned of soil contamination.

Seagrass mats (3,257 bales) were fumigated for insect infestation.

The 39,586 bales of cotton were processed under quarantine control. All bagging and droppings were either subjected to further processing or destroyed under supervision.

Kingsford Smith air terminal — The number of overseas flights into Kingsford Smith Airport increased to 7,950 from 7,505 in the previous year. The number of overseas passengers decreased slightly from 716,168 to 714,863. Items detained and forwarded for decision decreased from 405 to 249. A considerable quantity of prohibited goods intercepted and abandoned, including fruit, seeds and plants, was destroyed. The number of bond inspections increased from 1,959 to 3,149 and included perishables such as berry fruits from New Zealand.

Richmond RAAF base — Flights into Richmond decreased from 525 in the previous year to 487. Passengers increased from 5,896 to 6,756, and cargo increased from 11,371,000 lb to 15,452,000 lb. Goods quarantined included pallets, cases, curios and fruit. USAF parcel post yielded the usual restricted items requiring treatment or destruction.

The new quarantine facility at Richmond was completed. It expedited the fumigation of articles, where necessary, and enabled all garbage and rubbish to be incinerated immediately. The steam cleaning area was effective although some alterations remain to be made.

Inspections by appointment — Of the 1,323 inspections by appointment, 247 less than the previous year, 145 resulted in quarantine treatment or destruction. Inspections by appointment are mainly inspections of household effects on wharves or in bond. The main interceptions from household effects were furniture, antiques, artifacts and packing cases infected with borers. In addition, a considerable quantity of Chinese foodstuffs was examined and rice hulls were found as packing around bottles of sauce, and paddy rice in consignments of polished rice.

INSPECTION STATISTICS — N.S.W. PORTS

<i>Export Inspections</i>	1968-69	1969-70	1970-71
International Health Certificates issued	5,184	5,822	5,916
Export Permits issued	—	4,454	5,038
Fruit and Vegetables :			
Apples (bushels)	122,407	142,665	140,236
Pears (cases)	12,572	33,169	74,548
Oranges (bushels)	81,218	80,881	94,548
Mandarins (bushels)	4,904	1,798	1,880
Grapefruit (bushels)	1,068	2,199	2,398
Lemons (bushels)	1,355	3,849	1,621
Apricots (packages)	1,949	1,427	2,760
Peaches (packages)	13,581	12,323	21,804
Plums (packages)	4,795	8,419	14,905
Cherries (¼ bushels)	4,567	5,818	6,662
Nectarines (packages)	1,464	1,911	4,016
Grapes (cases)	13,346	14,956	16,783
Strawberries (cartons)	1,094	1,196	4,137
Tomatoes (cases)	21,025	21,275	29,683
Onions (bags)	—	—	124,334
Potatoes (bags)	—	—	60,919
Other vegetables (packages)	126,414	118,859	64,173
Grain and Flour :			
Wheat (tons)	1,919,253	2,572,987	2,587,425
Flour (tons)	89,206	97,867	82,036
Rice (tons)	76,610	81,055	59,910
Grain sorghum (tons)	—	—	102,745
Barley (tons)	—	—	6,646
Maize (tons)	—	—	8,291
<i>Quarantine (Import) Inspections</i>	1968-69	1969-70	1970-71
Quarantine Permits issued	41,700	51,781	58,760
Nursery stock (plants)	12,653	14,518	11,057
Parcel Post — packets detained for examination	10,394	11,659	11,297
Overseas flights — Mascot	6,693	7,505	7,950
Overseas passengers — Mascot	603,870	716,168	714,863
Overseas bond inspections	1,676	1,959	3,149
Overseas flights — Richmond	423	525	487
Overseas passengers — Richmond	2,779	5,896	6,756
Overseas freight (1b) — Richmond	19,895,000	11,371,000	15,452,000
Overseas vessels	1,031	1,307	1,014
Overseas vessels — passenger	268	245	280
Appointment inspections — household effects, etc.	1,089	1,560	1,323

Timber (su ft)	252,000,000	201,000,000	190,500,000
Cotton (bales)	—	23,400	39,586
Peanuts (bags)	—	109,820	29,243
Beans — processing (bags)	20,146	22,219	29,119
Soybeans — processing (tons)	—	—	4,821
Soybean meal (bags)	34,718	185,764	95,840
Copra (tons)	—	30,900	23,810
Nuts (packages)	—	117,127	61,601
Overseas containers ex container ships	—	44,946	51,197
Overseas containers ex conventional ships	—	—	17,000
Motor vehicles — new	21,080	23,566	31,558
Motor vehicles — second-hand	2,106	3,169	2,731

DIVISION OF ANIMAL INDUSTRY

GENERAL

PROFESSIONAL STAFF

Retirement

Mr W. J. B. Murphy (Principal Livestock Officer, Beef Cattle) retired after a lifetime's service with the Department as a veterinarian and as a livestock specialist.

Transfer

Dr W. A. Pattie (Principal Livestock Research Officer) was transferred to the position of Senior Lecturer in Animal Husbandry, Hawkesbury Agricultural College.

Appointments, Resignations and Vacancies

There were 28 appointments of professional staff, 10 resignations and two retirements. At June 30, 1971, there was one vacancy for a livestock research officer, two for veterinary officers, one for a livestock officer (Poultry) and two for chemists.

Advanced Degrees

The following officers were awarded advanced degrees: *Dr G. Gard* (Veterinary Research Officer) — Ph.D. from the Australian National University; *Mr J. R. Giles* (Research Officer) — M.Sc. from the University of N.S.W.; *Mr E. R. Hunt* (Veterinary Officer) — M.V.Sc. from the University of Sydney; *Mr B. J. McGuirk* (Livestock Research Officer) — MSc. from University of Edinburgh; *Mr R. A. E. Pym* (Livestock Research Officer) — M.Sc. from the University of N.S.W.; and *Dr B. R. Wilson* (Livestock Research Officer) — Ph.D. from the University of Alberta, Canada. Ten other officers were on leave for higher degree studies for whole or part of the year.

Overseas Visits

The following officers were overseas for whole or part of the year: *Mr R. B. Bonner* (District Veterinary Officer) — studies for Diploma in Animal Health at the University of London; *Mr R. D. Eastoe* (Principal Livestock Officer, Sheep and Wool) — visit to South Korea to arrange setting-up of a sheep project by the Department of Foreign Affairs under the Colombo Plan; *Dr A. R. Jackson* (Officer-in-Charge, District Veterinary Laboratory, Armidale) — visit to India, Turkey and Iran to organize control measures against diseases likely to affect sheep in the Hisar project being established in India by the Department of Foreign Affairs under the Colombo Plan; *Mr B. J. McGuirk* (Livestock Research Officer) — studies at the University of Edinburgh; *Mr D. J. Marshall* (District Livestock Officer, Sheep and Wool) — visits to livestock projects in U.S.A., Europe and Asia on the Star Rural Youth Travelling Scholarship; *Dr P. J. Mylrea* (Officer-in-Charge, District Veterinary Laboratory, Wollongbar) — attended a course in exotic diseases at Grosse Ile, Canada and visited Plum Island Foot and Mouth Disease Research Centre, U.S.A.; *Mr G. D. Slennett* (Principal Livestock Officer, Poultry) — attended the 14th World Poultry Science Meeting, the American Poultry Science meeting and the British Egg Marketing Board Symposium and also visited commercial and research poultry projects in the U.S.A., Spain, United Kingdom and India; *Dr B. R. Wilson* (Livestock Research Officer) — studies at University of Alberta, Canada; *Mr L. D. Beeby* (District Livestock Officer, Beef Cattle) — visited U.S.A. and U.K. with funds provided by the Commonwealth Extension Services Grant to study lot feeding; and *Mr D. M. Ryan* (District Livestock Officer, Beef Cattle) — visited New Zealand on a Royal Agricultural Society scholarship to study beef production.

LIVESTOCK HEALTH – FIELD ACTIVITIES

REGULATORY DISEASE CONTROL

Tuberculosis (Cattle)

Protected area scheme. — A further protected area was created during the year, bringing the total number of areas to 19. The new area, containing about 120,000 cattle, is in the south-west of the state where a significant proportion of cattle are dairy animals grazing irrigated pastures. It is the first protected area away from the coast.

Routine herd tests were mostly conducted by approved practising veterinarians at government expense. However, in some remote localities, tests were performed by veterinary officers of the Department. The latter also undertook retests of herds necessitated by the detection of reactors at routine tests. When reactors were so detected the herd concerned was quarantined and retesting was undertaken at intervals of two to four months until two tests at which no infection was detected had been completed. Because of the reduced incidence of tuberculosis, the intervals between routine herd tests was extended from two to four years in most areas. However, the system of compulsory identification of cattle being consigned for slaughter provided a monitoring system. When tuberculosis was found in carcasses, the herds concerned were quarantined and tested.

The 707,907 individual tests were a slight increase on the 700,151 tests of the previous year. Of the tests performed 0.062 per cent were positive, a reduction on the previous year's figure of 0.077 per cent and the lowest incidence of reactors since the area scheme commenced in 1960. There was a rise from 34,271 to 42,620 in the number of cattle requiring retest on account of the detection of reactors in the herds concerned.

Lesions of tuberculosis were not found in 50.0 per cent of reactors, a slight increase on the previous year's figure of 45.6 per cent. However, no visible lesion reactors represented 0.031 per cent of tests performed. The corresponding percentages for the previous two years were 0.035 per cent and 0.032 per cent, indicating a degree of stabilization. Particulars of testing in protected areas are summarised in the table. (See overleaf)

Tuberculosis testing was normally by the single intradermal test using synthetic medium tuberculin and performed in caudal fold. Results were usually read at the 96th hour but, because of evidence that some reactions have tended to subside before 96 hours, reading was undertaken at the 72nd hour in some problem herds. There was evidence that a residue of undetected tuberculosis remained in a small number of herds. In one herd tested because tuberculosis was detected in steers consigned for slaughter, there were 76 reactors out of 142 cattle tested with only 7 animals failing to disclose lesions at slaughter.

In an endeavour to improve diagnostic efficiency, a comparative retest was undertaken on this herd, using both synthetic medium and purified protein derivative tuberculin intradermally in opposite caudal folds. In this test the synthetic medium tuberculin failed to detect four cows with advanced lesions of tuberculosis and four with localised lesions. The purified protein derivative tuberculin missed three animals with advanced lesions and four with localised lesions. The former tuberculin caused reactions by three head which were negative to the purified protein derivative and which did not have lesions. Likewise, the purified protein derivative tuberculin produced a reaction in one animal without lesions which was negative to the synthetic medium tuberculin. The concurrent use of the two tuberculins resulted in the detection of an additional eight infected animals which would otherwise have remained undetected.

Further reactions due to infection with "skin" tuberculosis occurred in an area of the Hunter River Valley where this type of infection has been a problem for many years. The affected properties are located on an area of heavy black soil which tends to be muddy in winter time and it has been noted that most of these reactions have occurred at this time of the year. All cases of bovine tuberculosis were caused by *Mycobacterium bovis* except in three cases when *M. intracellulare*, serotype VI was isolated. These were in a three-day old calf with generalised atypical lesions, a case of "skin" tuberculosis and a herd with a reactor problem.

A change in policy permitted cattle being introduced to protected areas, to be tested on arrival at the destination instead of before entry, where difficulty is experienced in holding cattle for testing outside a protected area.

Tuberculosis Testing in Protected Areas, 1970-71

District	Purpose of test	No. of cattle tested	No. of Reactors	Reactors %	No. of Reactors NVL*	Reactors NVL* %
Central	Routine Retest	166,689 6,877	23 48	0.014 0.70	14 27	60.9 56.3
Cumberland	Routine Retest	93,845 9,563	46 88	0.049 0.92	21 51	45.7 58.0
North East	Routine Retest	266,420 24,883	56 140	0.021 0.57	26 56	46.4 40.0
South East	Routine Retest	37,234 479	— 1	— 0.21	— 1	— 100.0
South West	Routine Retest	43,515 818	32 —	0.074 —	21 —	65.7 —
	Total Routine	607,703	157	0.026	82	52.2
	Total Retest	42,620	277	0.65	135	48.7
	Introduction	57,584	8	0.014	4	50.0
	Grand total	707,907	442	0.062	221	50.0

* NVL = No visible lesions

Control outside protected areas. — Outside protected areas, testing was confined to herds suspected of being affected. Such herds were quarantined and testing continued until two negative tests had been obtained. Initial testing was by approved practising veterinarians at government expense except where practitioners were unavailable. In those cases testing was by official veterinarians. All herd retests necessitated by the detection of reactors at initial tests were by government officers.

The extent of testing outside protected areas was greatly increased; 219,840 cattle were tested compared with 59,601 in the previous year. Reactors numbered 1,467 representing a disease incidence of 0.67 per cent. Most of the testing involved cattle introduced into N.S.W. from known infected herds in Queensland and South Australia. However, the compulsory identification of sale cattle by tail tags bearing serial numbers indicating herds of origin enabled 166 head of N.S.W. cattle, in whose carcasses tuberculosis was found at abattoirs, to be traced. Cattle tested as a result of these traces were on 72 properties; 66,387 head were tested. Difficulty was experienced in eliminating infection from several herds. In one such herd where sporadic reactors continued to occur at retests, the use of purified protein derivative tuberculin detected an advanced case of the disease which had previously not reacted to synthetic medium tuberculin. In another herd, drum rollers containing a urea-molasses lick were found to be spreading tuberculosis.

Where possible tuberculosis diagnosed in carcasses at abattoirs was confirmed by laboratory examination, except in the case of cattle from known infected herds. With this policy the 343 bovine specimens submitted from 217 head of cattle resulted in confirmation of 158 animals as infected. Those found to be nontuberculous disclosed a variety of conditions, the principal being squamous cell carcinoma, actinobacillosis, atypical granulomata and degenerated hydatid cysts.

A significant change has occurred in the pattern of tuberculosis in the past decade. Most infection occurred in dairy herds when the official scheme commenced in 1960. However, because control measures have been successful in dairy cattle and have only recently commenced in earnest in beef herds, 85 per cent of reactors detected in 1970-71 were beef animals.

Payments to approved practitioners for testing both within and outside protected areas totalled \$318,756.

Tubercule-free herd scheme. — In this scheme of voluntary accreditation, 43 herds containing 5,764 head of cattle were tested. There were 14 reactors. A further 26 herds, accredited during the previous year for two years, were not tested.

Tubercule-free milk schemes. — These schemes involve herds in which milk is sold unpasturised. One scheme which applies to the large cities is administered by the N.S.W. Dairy Industry Authority. Under this scheme 6,289 cattle were tested. There were four reactors. Municipal* and shire councils supervise the other scheme for small cities and towns. There were 12 reactors in the 1,788 cattle tested.

Tuberculosis (Pigs)

There were four pig herds placed in quarantine because of tuberculosis while quarantine was maintained on another herd quarantined in the previous year. No herds were released. Pigs were tested on 11 properties and 195 reactors were detected from the 831 tested.

Of the 205 pig specimens subjected to pathological and bacteriological examination for suspected tuberculosis, 107 were confirmed as being tuberculous. The following isolates of *Mycobacterium* spp. were obtained from pigs: *M. bovis* — 15 isolates; *M. avium* — serotype II — 33; *M. intracellulare* — serotype VI — 3; *M. intracellulare* — serotype Davis — 3; and *M. intracellulare* — serotype Dent — 1.

One problem herd was encountered in which *M. bovis*, *M. intracellulare* and *M. avium* were present. An initial test of 83 head yielded 8 reactors. On slaughter all reactors showed lesions, as also did 20 of 42 non-reacting pigs. Arrangements were in hand for the remainder of the herd to be consigned for slaughter.

Tuberculosis (Sheep)

Mycobacterium avium (serotype II) was isolated from lesions characteristic of tuberculosis in the small intestine and mesenteric lymph glands of a sheep.

Tuberculosis (Poultry)

Tuberculosis was detected during the year in 21 flocks. They were placed in quarantine. Control was by sanitation. Quarantine was also maintained on a further 24 flocks found to be infected before the start of the year. Fifteen flocks were released from quarantine after the disease was considered to have been eradicated. The tuberculin test was not employed as a routine for control, but 14 birds on two properties were tested; there were 6 reactors.

Brucellosis (Cattle)

Phase one of the brucellosis control programme, based on the recommendations of the National Sub-committee for Tuberculosis and Brucellosis, was commenced during the year. This phase consisted of the compulsory vaccination of female calves. The work was normally carried out by approved practising veterinarians at government expense but vaccinations were undertaken by government veterinarians where practitioners were unavailable. It is intended that this phase will continue until infection has been reduced to a level where test and slaughter can be applied.

The scheme provides for the vaccination of all calves within protected areas as gazetted for the control of tuberculosis. In addition, one protected area on the North Coast was gazetted specifically for brucellosis. Outside these areas, vaccination is undertaken under the same conditions in herds found to be infected. The properties concerned are constituted as quarantine areas by agreement with owners, although no restrictions are applied to the introduction or removal of cattle.

Originally strain 19 vaccination was restricted to calves between the ages of three and six months except in special circumstances. Later, the maximum age of vaccination was extended to nine months after adoption of the complement fixation (CF) test as a check test for serum samples positive to the serum agglutination test (SAT). Originally, strain 45/20 was the only vaccine permitted for older stock and then only at the discretion of the District Veterinary Officer. Later, because of the advent of the CF test, the use of strain 19 vaccine on adult cows was allowed with the approval of the District Veterinary Officer. Distinctive ear marks were used for the identification of calves vaccinated with strain 19 under nine months, with strain 19 above this age and cattle vaccinated with strain 45/20.

Within protected areas, 186,750 calves were vaccinated in 4,667 dairy herds and 258,973 calves in 12,843 beef herds. Outside protected areas, 3,824 calves were vaccinated in 135 dairy herds and 116,318 calves in 2,712 beef herds. Adult cows vaccinated numbered 2,996 dairy animals and 27,643 beef cattle. It is estimated that, within protected areas, 90 per cent of the dairy calf drop and 84 per cent of the beef calf drop were vaccinated. Outside protected areas the estimated figures were 42 per cent and 15 per cent respectively. Payments to practising veterinarians for vaccination totalled \$249,245. Post-vaccination anaphylactic-type reactions led to the deaths of a small number of calves on several properties. Symptoms were frothy oral exudate and dyspnoea. Necropsies revealed pulmonary oedema. In one case, diarrhoea occurred two to three hours after vaccination.

To establish which herds outside protected areas were infected, large scale surveys were undertaken. These included the submission of serum samples from cattle on farms suspected of being infected, from randomly selected cattle on farms, from cattle being slaughtered at abattoirs and the performance of the milk ring test at depots and factories. In the field survey, serum samples were tested from 4,370 cows in dairy herds and 38,490 cattle in beef herds. This survey led to 44 dairy herds and 568 beef herds being classed as infected, representing 32 per cent of herds surveyed. A further 2,783 dairy herds were surveyed by 4,422 milk ring tests. Of these 1,345 or 48 per cent were classed as infected. Tests of 15,915 serum samples from abattoir cattle resulted in the recognition of 5 infected dairy herds and 653 infected beef herds.

The policy was adopted of using the SAT for initial tests and CF tests as check tests to distinguish between antibodies due to infection and vaccination. The CF test was used on survey sera when the SAT reaction was 30 or more IU, on diagnostic sera whose reaction was 30 to 100 IU and on diagnostic sera with SAT reactions greater than 100 IU if there was a history of strain 19 vaccination.

The 128 isolates of *Brucella abortus* were forwarded to the Brucella Reference Laboratory, Commonwealth Serum Laboratories, Melbourne. Of these 117 were biotype 1, 20 were biotype 2 while one was biotype 4. One strain of *Br. abortus* biotype 1 appeared to be an erythritol tolerant variant of strain 19.

Brucellosis (Pigs)

No cases of brucellosis were diagnosed in pigs. In 827 pigs tested for the disease, there were ten doubtful reactions, all of which on retest proved negative.

Anthrax

There were 18 outbreaks of anthrax, comparable to the 17 outbreaks in 1969–70 and significantly less than the 31 in 1968–69. All outbreaks were in the recognised “anthrax belt” in the west of the state. One outbreak was not reported until after the owner had developed the disease from skinning a dead sheep.

Details of the outbreaks were: in 10 outbreaks in the south west district — 550 cattle, 4,046 sheep and 487 pigs were quarantined and 10 cattle, 138 sheep and 37 pigs died; in 8 outbreaks in the west district — 709 cattle, 20,395 sheep, 235 pigs and 9 horses were quarantined and 13 cattle and 499 sheep died.

Stock vaccinated during the year totalled 128,892 on 183 properties. The number vaccinated was less than in the previous year, when 225,529 were vaccinated on 217 properties. Quarantine was again imposed during the summer months on stock reserves on which anthrax had occurred during the preceding five years. The same ten stock routes quarantined last year were again quarantined and use was restricted to stock vaccinated against anthrax or being transported by motor vehicle.

Pleuropneumonia contagiosa

Pleuropneumonia contagiosa—(PPC) did not occur during the year. PPC was monitored by submitting to the CF test as many as possible of the samples of sera received at the Veterinary Research Station for other tests; 36,073 samples were tested for PPC. Seven head of cattle returned positive reactions but were negative on retest.

Johne's Disease

Of the nine clinical cases of Johne's disease, seven were on a property on the far south coast on which the disease has been established for 35 years, one was on another property in the same area and one was on the north coast. This is the first case on the north coast for many years. As in the past, the correlation between the CF test and bacteriological findings was poor — 3,930 serum samples were tested.

Footrot (Sheep)

At the commencement of the year 16 properties in the New England Protected Area were in quarantine on account of the presence of footrot. During the year a further 23 properties were quarantined following the detection of new outbreaks, while 19 holdings were released from quarantine after the disease was considered to be eliminated. The infection was successfully overcome by treatment alone on 9 of the 19 holdings, by treatment combined with disposal of obstinate cases for slaughter on 4 and by sending all infected and in-contact sheep for slaughter on 6. Of the 16 flocks in quarantine at the beginning of the year, 11 were still infected at the end of the year.

In the Protected Area, the summer was the wettest for five years and for the greater part of the year conditions were conducive to the spread of footrot. Particular attention was paid to sheep introduced to the area — owners are required to give notice of introductions. Because the staff position permitted only a limited number of introductions to be inspected, efforts were concentrated on the inspection of sheep from regions where the disease is known to be enzootic. Additional equipment was purchased for use in the area.

Elsewhere in the state, particularly in southern and western areas, seasonal conditions also favoured the occurrence of the disease. Continued wet conditions in many districts caused clinical cases to occur well after the normal spring period and in some cases throughout the summer. The disease was unusually troublesome to prime lamb producers. In the past years, the occurrence of footrot on such a scale would have aroused considerable interest in eradication measures. However, during 1970–71 this interest was lacking because of the promise of a commercial vaccine against the disease and because the low wool prices made the expenditure necessary to achieve eradication uneconomic. Field trials of the vaccine by a commercial enterprise in conjunction with district officers began late in the year.

Trichomoniasis (Cattle)

An infertility problem in a small beef herd in the central west of the state was found to be due to infection with *Trichomonas foetus*. The source of the infection was not determined. An investigation in an adjoining herd where there was a fertility problem did not reveal any evidence of the disease. Although it was relatively common in coastal dairy herds a decade ago, only isolated outbreaks of Trichomoniasis have been diagnosed in recent years. The current outbreak is only the second diagnosed in a beef herd in N.S.W. Control is by mating exposed animals to a sacrifice bull to be subsequently consigned for slaughter and mating unexposed females to clean bulls.

External Parasites (Sheep)

Numbers of properties and sheep quarantined on account of infestation with sheep lice (*Damalina ovis*) and sheep ked (*Melophagus ovinus*) are shown in the following table.

District	Lice		Ked		Lice and Ked	
	No. Sheep	No. Farms	No. Sheep	No. Farms	No. Sheep	No. Farms
Central	7,150	7	-	-	-	-
Central West	127,372	98	8,763	6	3,603	2
Cumberland	2,063	7	-	-	-	-
Far West	260,136	81	-	-	-	-
North	105,346	89	12,880	9	5,812	5
North West	28,870	27	-	-	-	-
South	169,028	145	-	-	-	-
South East	51,666	47	10,182	14	2,940	4
South West	566,173	357	-	-	-	-
West	70,100	43	-	-	-	-
Totals	1,387,904	901	31,825	29	12,355	11

Regulations were introduced requiring the occupiers of all sheep properties within the Western Division of the state to notify an inspector of intention to shear sheep. The regulations followed the declaration of a protected area and the purpose was to permit inspection for lice in an area where holdings are large and the stocking rate low.

Salmonellosis

Salmonellosis occurred widely throughout the state. Most outbreaks were in calves but there were many in pigs. A small number occurred in sheep and adult cows. Apart from *Salmonella pullorum* there was little *Salmonella* infection in poultry. Only small numbers of adult cattle were affected in any herd.

The extent of the disease in calves was greater than in previous years and was due to the increase in the practice of purchasing dairy calves in coastal areas and transporting them inland for rearing under intensive conditions. Many of the outbreaks occurred in this type of establishment with losses of up to 40 per cent.

The following table shows the isolations of *Salmonella* spp. from specimens submitted for laboratory examination.

	Bovine	Ovine	Porcine	Avium	Equine	Total
<i>S. adelaide</i>	-	-	-	1	-	1
<i>S. anatum</i>	-	-	1	1	-	2
<i>S. bareilly</i>	-	-	-	1	-	1
<i>S. bovis—morbificans</i>	9	3	3	-	-	15
<i>S. chester</i>	-	-	1	-	-	1
<i>S. cholerae—suis</i>	-	-	17	-	-	17
<i>S. dublin</i>	3	-	-	-	-	3
<i>S. give</i>	-	-	2	-	-	2
<i>S. kottbus</i>	-	-	1	-	-	1
<i>S. meleagridis</i>	-	-	1	-	-	1
<i>S. newington</i>	-	-	-	1	1	2
<i>S. orion</i>	-	-	1	-	-	1
<i>S. potsdam</i>	1	-	-	-	-	1
<i>S. pullorum</i>	-	-	-	6	-	6
<i>S. singapore</i>	-	-	-	1	-	1
<i>S. typhimurium</i>	45	4	6	11	2	68
Totals	58	7	33	22	3	123

Many other outbreaks were diagnosed solely on the clinical picture and the gross pathology.

Pullorum Disease

Control of pullorum disease continued under the voluntary accredited flock scheme and regulations under the Stock Diseases Act which require the testing of flocks from which chickens under three weeks of age or hatching eggs are sold.

The field test used was the rapid whole blood stained antigen agglutination test. Where a change in status was involved or where a significant number of doubtful reactors were detected in the absence of positive reactors, the birds were submitted to the Veterinary Research Station, Glenfield. There, check rapid tests and where necessary cultural work were undertaken on the birds.

Field testing for pullorum is summarised in the following table.

Scheme	No. of Flocks	No. of Birds	No. Positive	Positive %	No. Doubtful	Doubtful %
Accredited flocks						
Sydney area	55	612,140	54	0.008	521	0.08
Country area	13	124,192	205	0.16	168	0.1
Total accredited	68	736,332	259	0.03	689	0.09
Compulsory testing						
Sydney area	24	56,752	221	0.39	127	0.22
Country area	10	31,516	132	0.42	14	0.04
Total compulsory	34	88,268	353	0.41	141	0.16

In the accredited scheme the percentage of reactors decreased from 0.47 per cent in the previous year to 0.03 per cent and the number of flocks tested decreased from 76 to 68. Flocks under compulsory testing remained at 34 but the number of birds tested rose from 73,159 in the previous year to 88,268. There was an increase in the reactor rate from 0.2 per cent to 0.41 per cent.

A breakdown occurred in one accredited flock in which 50 positive reactors and 15 doubtful reactors were detected from 3,000 breeders at an annual test. The test was confirmed by the isolation of *Salmonella pullorum*.

Avian Encephalomyelitis

Regulations were introduced under the Stock Diseases Act permitting only authorised persons to carry out controlled exposure of birds to the causal virus and prohibiting the use of unapproved vaccines against the disease.

Marek's Disease

Marek's disease was proclaimed under all provisions of the Stock Diseases Act except that requiring notification of the existence of the disease. The proclamation was principally aimed at providing control over commercial vaccines against the disease.

GENERAL DISEASE PROBLEMS

Mastitis

The mastitis control programme continued. It commenced during 1969 and is organised by a committee comprising the Divisions of Animal Industry, Dairying, Marketing and Economics, the Biological and Chemical Research Institute and the Biometrical branch of the Department together with the University of Sydney and the N.S.W. Dairy Industry Authority.

The first phase of the scheme is aimed at providing data for an educational programme for dairy farmers. Observations have been undertaken in 35 selected commercial dairy herds in various parts of the state to provide information on the incidence of mastitis, the effect on production and the success and economic benefit of control measures. Control is based on efficient operation of milking machines, udder washing and stimulation before milking, teat disinfection after milking and removal of the source of infection through treatment of clinical cases during lactation, dry period therapy of quarters positive to the rapid mastitis test (RMT) at drying off, segregation of affected cows and culling of refractory cases. During the year, cows in the demonstration herds were subject to monthly RMTs and bacteriological examination of milk from RMT positive quarters at three monthly intervals. Antibiotic sensitivity tests of pathogens isolated at these examinations were conducted. Particulars of the causal organisms identified at the initial base period and at two subsequent periods in the demonstration herds, are shown in the following table.

Percentage of Quarters Positive

Stage	RMT	<i>S. aureus</i> %	<i>S. agalactiae</i> %	<i>S. dysgalactiae</i> %	<i>S. uberis</i> %
<i>Base Period</i> (35 Herds)	33.2	25.1	4.4	1.3	1.5
<i>Control Period</i> After 12 months (35 Herds)	14.7	12.6	0.4	0.8	1.5
After 24 months (18 Herds)	14.6	9.6	0.8	0.6	0.9

Results to the end of the first year showed a marked drop in the incidence of RMT positive quarters and pathogens. This improvement continued at a lower rate in the second 12 month period. During this time an epizootic of ephemeral fever caused the milk of some cows to react to the RMT. Preliminary economic and biometrical evaluation of the results has commenced. The programme has been continued for a further 12 months to enable all cows in the demonstration herds to complete two lactations during the observation period.

Staphylococcus aureus was the predominate organism isolated from most herds. The trend of previous years of a high level of resistance of this organism to penicillin continued, with up to 100 per cent of isolations from some herds proving resistant. Resistance by this organism to streptomycin was also encountered but to a lesser degree. In one demonstration herd, an isolate of *S. aureus* was the resistant to cloxacillin.

Apart from the demonstration herds, a campaign was undertaken to induce more widespread adoption of sanitation and control measures, particularly in the Illawarra area. In this area bail hoses were being used in 78 per cent of the problem herds investigated compared with 43 per cent of similar herds investigated during the previous year. Corresponding percentages of use of udder soap

were 31 per cent and 14 per cent, teat dipping 20 per cent and 7 per cent, and paper towels 20 per cent and nil. Resistance to penicillin was shown by 86 per cent of *S. aureus* isolates, the same as in the previous year, but the isolates of these organisms resistant to streptomycin increased from 21 per cent to 37 per cent.

In one herd in which a number of heifers and mature cows developed acute mastitis with constitutional symptoms from one week before to one week after calving, *Bacillus cereus* and large numbers of *Pasteurella pseudo-tuberculosis* were isolated from milk samples. These organisms were resistant to penicillin, cloxacillin and spiramycin. Unusual outbreaks of gangrenous mastitis were seen in beef cattle in four herds following heavy rain and lush pasture growth. Treatment with antibiotics was successful where the infection was not too advanced.

Leptospirosis

The dying-off syndrome reported last year was found to be due to *Leptospira hardjo*. A further epizootic occurred during the summer. It was particularly prevalent in the Illawarra area where an estimated 10 to 20 per cent of herds were affected. The infection also caused outbreaks of clinical disease in herds in other parts of the state.

The principal signs were pyrexia and anorexia with a marked decline in milk production. Milk of affected cows contained yellow clots and gave strongly positive reactions to the rapid mastitis test in the initial stages and an intensively yellow stain on sediment pads. The disease caused heavy rejection of milk at factories and depots. Some cows aborted. While most cases recovered spontaneously, treatment with streptomycin or chloramphenicol appeared to hasten recovery and reduce the risk of abortion.

Leptospira pomona was also incriminated as a common cause of abortion in cattle and to a lesser extent of mortality in calves. In pigs, leptospirosis was manifest by abortion, the birth of dead pigs and the death of suckers soon after birth. Serological testing indicated that *L. pomona* was mainly responsible although *L. tarassovi* was the pathogen in some cases.

Of the 6,801 cattle sera tested, 841 were positive and 652 doubtful and of 621 pig serum samples, 84 were positive and 43 negative.

Ephemeral Fever

Ephemeral fever first occurred as an epizootic in Australia in 1936–37 when cattle over a wide area of N.S.W. were affected. Apart from a minor localised outbreak in 1947, no further major epizootic was recorded until 1956–57. In 1967–68 there was another epizootic involving the whole of N.S.W. and which, on previous history, would have been expected to give a respite from the disease for a decade. However, another statewide epizootic, although somewhat milder than the previous major outbreaks, occurred during 1970–71.

The disease first appeared in Queensland during late 1970 and entered the far west of N.S.W. near Bourke in mid-December. From there it rapidly spread fan-wise reaching the western section of the Victorian border and the north coast of N.S.W. by the end of December. By mid-January the disease had spread to the Hunter Valley and the south western slopes, and outbreaks were occurring through the whole of the northern portion of the state. The disease had spread throughout the Hunter Valley and had appeared in the Sydney area by late January. By February, ephemeral fever had covered almost the whole of the state, the last region to be affected being the south east where only a small number of sporadic outbreaks were recorded. The disease commenced to wane in the northern part of the state during March and in southern parts in April, after which clinical evidence of the disease practically disappeared.

In most parts of the state, morbidity in affected herds was comparatively low, usually below 10 per cent. Many herds escaped altogether. In the more closely settled parts of the state, and along the major rivers, the incidence was higher. Greater numbers of herds were affected and morbidity within the herds often reached 40 per cent and was up to 70 per cent in some cases. When the disease first appeared, bulls and aged cows were the animals mostly affected but later all classes of cattle showed symptoms. Sporadic deaths were reported.

A syndrome of dyspnoea and pulmonary emphysema was associated with the outbreak in a number of dairy herds in coastal districts. In very severe cases cattle so affected died within two hours of the onset of symptoms. Less severely affected animals usually died within 12 to 24 hours. Some recovered after receiving large doses of antihistamines but in others there was no response. The consistent necropsy finding in such cases was emphysema and marbling of pulmonary tissue. Histopathological examination of affected lungs showed, as well as emphysema, alveolar capillary congestion, bronchiolitis and fluid exudation into the alveoli.

Sporadic Bovine Encephalomyelitis (SBE)

Outbreaks of SBE continued to occur widely in cattle in the northern parts of the state, particularly during the summer months. Young stock were mainly affected and a number of deaths were recorded. Studies of the serology of the disease indicated that maximum titres to the complement fixation test developed about three weeks after the disease was clinically evident, after which they progressively declined over a period of some months.

Encephalomyocarditis in Pigs

Cases of encephalomyocarditis continued to occur in pigs during the early part of 1970–71 following the severe epizootic associated with a severe mouse plague during the previous year. Losses were not generally heavy. The disease was confirmed by transmission trials using mice while neutralising antibodies were detected in a number of herds. Re-examination of histopathological heart material from an undiagnosed mortality in pigs four years previously revealed lesions consistent with this disease.

Infertility

Vibriosis continued to be a major cause of infertility in cattle and was controlled by artificial insemination, antibiotic treatment, and in some cases, vaccination. Other causes were undernutrition, orchitis and trichomoniasis (reported in the section "regulatory disease control").

Fertility problems were not commonly encountered in sheep. When they were, epididymitis due to *Brucella ovis* was the most frequent cause. Although brucellosis occurred widely, owners were usually able, by removal of advanced cases, to maintain the infection at a level at which fertility was not impaired. Of the 5,353 serum samples submitted to the complement fixation test for this disease, 348 were positive. *Actinobacillus seminis* was also a cause of epididymitis with impaired fertility in some flocks. In one flock, which had been under observation for a number of years on account of a severe problem from this infection, a low incidence of epididymitis was encountered during 1970–71. Earlier, the rams had been treated with chloramphenicol and/or sulphadimidine to control an outbreak of pneumonia, but whether this treatment influenced the incidence of epididymitis is not known. In a small number of flocks, phyto-oestrogens due to the ingestion of subterranean clover (*Trifolium subterraneum* var *Dwalganup*) was suspected of being the cause of lowered breeding performance.

Erysipelas

A number of outbreaks of erysipelas in pigs were encountered. This was the most important disease in pigs in 1970–71. Infection was manifested by septicaemia, polyarthritis and abortion. In recent years, there has been a significant increase in the proportion of pigs carcasses condemned at abattoirs on account of arthritis, most of which is believed to be caused by *Erysipelothrix insidiosa*.

Cysticercus bovis

The survey conducted in association with the Commonwealth Department of Primary Industry continued. Suspected lesions submitted from abattoirs by Meat Inspectors were examined at the Veterinary Research Station, Glenfield, but only 5 of 29 showed recognisable scolices of *C. bovis*. The other lesions submitted were probably degenerated cysticerci.

Equine Infectious Anaemia

Investigations indicated that the death of two out of ten horses on a property on the northern tablelands after rapid loss of condition was due to equine infectious anaemia. Histopathological examination of spleen and liver showed changes typical of the acute to sub-acute form of the disease. The source of the infection was not determined.

Bacillus cereus

Bacillus cereus was isolated from the tissues of cattle following a syndrome resembling anthrax and also from another in which symptoms of tetany were shown before death. The organism was also isolated from an outbreak of pneumonia in pigs and from cattle affected with acute mastitis.

Mycoplasmosis (Pigs)

A histopathology consistent with *Mycoplasma hyorhinis* infection was seen in specimens received at the Veterinary Research Station, Glenfield, from a minimal disease piggery. The principal necropsy finding was acute serositis.

Poisoning

Nitrite. — Many mortalities in sheep and cattle were investigated following the ingestion of plants containing nitrate. The most common source of the poison was variegated thistle (*Silybum marianum*) mostly grazed in the paddock but on occasions ingested as a contaminant of hay. Grazing oats was also a source of nitrite poisoning. Some deaths occurred from the ingestion of hay contaminated with mintweed (*Salvia reflexa*). Ingestion of the plant mother-of-millions (*Kalanchoe tubiflora*) also caused mortalities from nitrite poisoning.

Algae. — Three cases of mortality in cattle and one in sheep, in which 200 Merino weaners died, were found to be due to ingestion of blue-green algae (*Anacystis cyanea*) from the surface of dams. *Anabaena circinalis* contaminating a dam was incriminated as the cause of the death of two cows while red algae (*Euglena rubra*) were suspected of causing the death of a calf.

MISCELLANEOUS ANIMAL HEALTH MATTERS

Extension Services by Veterinarians

Much extension work by veterinary officers and veterinary inspectors was with individuals. The following use was made of mass and group methods of contact with farmers in 1970–71 (1969–70 figures in brackets): press items — 250 (243); radio broadcasts — 76 (58); telecasts — 3 (12); addresses to meetings — 54 (70); field day sessions — 6 (35); and newsletters — 2 (7).

Pressure of work arising from the expansion of the tuberculosis control scheme and the introduction of the campaign against brucellosis reduced group extension. However, increased use was made of the mass media, particularly radio. Exhibits on an animal health theme were staged at two country agricultural exhibitions.

Where possible, owners of sheep and cattle whose carcasses were found to be infected with hydatid cysts at abattoirs were contacted and advised about control measures. In addition, in two centres, more intensive campaigns to encourage hydatid control were undertaken in conjunction with the Department of Public Health and shire councils.

Two surveys were undertaken regarding livestock health problems.

Extension objectives of officers depended on their particular districts. They concerned disease control and aspects of husbandry related to animal health and production.

Publications

Four issues of "Veterinary Notes" were produced and distributed to veterinary personnel and also to veterinarians outside the Department servicing the state's livestock industry. An issue of the "Livestock Health and Husbandry Report" for 1969–70 covering the work of the Division of Animal Industry was prepared.

In-Service Training

Veterinary officers and veterinary inspectors attended courses in the importance of disease control in the livestock economy and in beef cattle production conducted by the University of Sydney's Post-graduate Committee in Veterinary Science. Veterinary officers and veterinary inspectors also attend extension methods schools conducted by the Division of Extension Services. One veterinary officer attended a short course in agricultural extension at the University of Queensland.

Newly appointed veterinary officers and veterinary inspectors spent several days at the Veterinary Research Station, Glenfield, when first appointed, while veterinary inspectors also spend several weeks with an experienced inspector before proceeding to district appointments.

Conferences

A two-day conference of senior veterinary officers was held at Head Office. The Division was also represented at an extension workshop for senior officers of the Department at Hawkesbury Agricultural College. Most veterinary inspectors attended the Annual Conference of the Veterinary Inspectors' Institute.

Colombo Plan Fellowships

A field day was held at the Veterinary Research Station, Glenfield, for students of the International Training Course in Poultry Husbandry sponsored by the Commonwealth Department of Foreign Affairs. Two Colombo Plan fellows undertook study periods at the Research Station.

Government Farms

Veterinary officers of the Department provided a clinical and disease control service for livestock located at research stations and farms administered by the Department of Agriculture and other government departments. During the year 284 such services were given. Work included clinical examinations, treatment, surgery, post-mortem examinations, vaccinations, testing for disease, pregnancy determinations and inspection prior to sale or purchase.

Exotic Diseases

A veterinary research officer attended an intensive training course in Canada in which course members were able to follow actual cases of a number of diseases through all stages from the time of infection. He also visited the United States to observe foot and mouth disease research and preparations made to diagnose suspected exotic diseases occurring there. Another veterinary research officer visited India and Iran to gain experience in diseases occurring in those countries.

Arrangements were made for a series of exotic disease training courses for veterinary officers, veterinary inspectors, rangers and cattle inspectors in 1971-72. The courses will cover the most important exotic diseases and include a simulated outbreak of foot and mouth disease with eradication procedures on farms controlled from emergency headquarters.

The 24 shire property maps produced by the Valuer-General's Department were distributed for use in the event of an exotic disease outbreak. They are also proving very useful for current disease control programmes.

Introductory sections were prepared for a handbook on exotic diseases. The handbook will detail diagnostic procedures for more than 20 serious exotic diseases and the action to be taken when an exotic disease is encountered.

Work commenced on compilation of a detailed eradication plan for swine fever and African swine fever to serve as a model for all Australian states.

Artificial Breeding

All bulls selected for artificial insemination centres are first held at the Veterinary Research Station, Glenfield, for tuberculin and serological tests and for test-mating for genital diseases. During the year, 30 bulls were so tested; two were rejected because of serum agglutination titres to *Brucella abortus* and one because of a doubtful tuberculin reaction. Bulls already at artificial breeding centres had annual tests for tuberculosis, brucellosis, leptospirosis and contagious pleuropneumonia and, as a precaution, were simultaneously treated for vibriosis.

The procedure for testing bulls required for artificial insemination centres was changed to replace test mating to heifers by the examination, including fluorescent antibody technique, of penile and preputial scrapings of bulls. To enable the fluorescent antibody technique to be used for the diagnosis of vibriosis, rabbit anti-serum against *Vibrio fetus* was prepared and is to be conjugated to fluorescein isothiocyanate.

A new, privately-owned artificial insemination centre was registered primarily to service beef cattle. It became the fourth centre in N.S.W.; two are operated by the Dairy Industry Authority and two privately. Preparations were commenced for two further privately-owned centres, indicating the greatly increased interest in artificial insemination of beef cattle.

The Dairy Industry Authority, in conjunction with this Department, conducted a seven-day course in the technique of artificial insemination for stock owners wishing to inseminate their own cows. The first privately conducted organization for training inseminators also commenced operations during the year. The trainees came almost entirely from beef cattle properties.

Of 18 candidates examined for the Certificate of Competency under the Stock (Artificial Insemination) Act, 17 were successful.

Laboratory Diagnostic Services

The volume of specimens submitted to the Veterinary Research Station, Glenfield and the District Veterinary Laboratories, Armidale and Wollongbar increased markedly for the second consecutive year; 13,713 specimens were received by the three laboratories compared with 11,637 in the previous year. The largest increase was in the number of cattle specimens and resulted from adoption of the practice of having suspected lesions of tuberculosis detected at abattoirs forwarded for confirmation. Increased use was made of the Department's laboratory services by veterinary practitioners. Increased diagnostic work reduced the time available for research.

The following table shows the number of consignments of specimens received at the three laboratories.

Class of specimens	Glenfield	Armidale	Wollongbar	Total
Cattle	6,234	1,391	1,275	8,900
Sheep	1,315	311	-	1,626
Poultry	607	142	28	777
Pigs	991	172	237	1,400
Horses	94	-	-	94
Other species	476	76	35	587
Plants	94	-	-	94
Miscellaneous	205	15	15	235
Totals	10,016	2,107	1,590	13,713

Sources of diagnostic material were:

Source	Glenfield	Armidale	Wollongbar	Total
Departmental officers	4,524	470	565	5,559
Veterinary inspectors	2,175	660	408	3,243
Veterinary practitioners	3,055	935	597	4,587
Others	262	42	20	324
Totals	10,016	2,107	1,590	13,713

Rabbit Myxoma Virus

In addition to 129,680 doses of rabbit myxoma virus distributed to graziers and Pasture Protection Boards in N.S.W., 11,000 doses were sent to rabbit control authorities in Queensland, South Australia, Western Australia and the Australian Capital Territory and to CSIRO. These demands were similar to those made over the last few years.

The technique for producing the virus was modified to avoid gross contamination of the work area with virus and to make more economical use of labour. In the modification the virus is dispensed as a liquid suspension into bottles containing diatomaceous earth and the mixture is freeze-dried. This allows the use of automatic dispensing equipment. Most of the virus has been grown in the usual manner by inoculation onto the scarified back of a rabbit but a successful batch of virus was produced on cell culture. It is intended to change to this method of growth when present stocks are exhausted. Seed virus for the infection of cell cultures will continue to be produced and maintained by passage in rabbits.

Testing of Vaccines

Samples of commercial vaccines were routinely examined. In one sample of an anthrax vaccine in a plastic container, the spore counts were unsatisfactory. Repeat counts, performed on the same batch several months later, indicated a marked drop in the spore count. Further examination two months later showed a still further drop. It was suspected that the type of container may have been responsible and the manufacturer was advised to change to glass bottles.

MATTERS ARISING FROM SOME OF THE ACTS

Cattle Compensation Act

Claims approved for payment totalled 7,183, an increase on the 6,475 in 1969–70. The number of cattle for which compensation was paid also increased, from 9,290 to 11,899. Compensation was paid for 11,390 cattle ordered to be destroyed on account of suspected disease and for 509 carcasses condemned at abattoirs. Particulars of claims for the various diseases were:

Disease	Claims	Animals	Payment \$
Tuberculosis	571	1,483	80,222.28
Cancer	4,428	6,295	230,550.91
Actinomycosis	1,649	3,458	65,085.10
Actinobacillosis	529	657	24,452.26
Pleuropneumonia contagiosa	—	—	—
Trichomoniasis	—	—	—
Tick fever	—	—	—
Johne's disease	5	5	514.62
Vibriosis	1	1	90.00
Totals	7,183	11,899	400,915.17

Reasons for disallowing claims for compensation were: delayed notification by owners — 298 cases; failure to notify disease — 28; failure to pay levy or submit return — 78; failure to maintain slaughter register — 7; and, delayed application for compensation — 6 cases.

The amount of compensation payable was reduced in 90 other cases where claims were not submitted within 60 days of slaughter of cattle. In the case of 54 claims, the residual carcass value exceeded the agreed marked value before slaughter and no compensation was paid.

A regulation was promulgated under the Act raising the maximum market value payable from \$100 to \$150 per head. Particulars regarding the cattle compensation fund are furnished in the Accounts Section of this report.

Stock Foods and Medicines Act

Stock foods. — Registration was granted for 1,826 stock foods, a slight increase on the 1,710 registrations last year. All manufacturers were required to furnish particulars of antibiotics present in any food. Some 248 samples of stock foods were submitted to the Department's Biological and Chemical Research Institute where analysis showed that the composition of 62 samples failed to conform to that stated on the labels. The principal aberrations were a deficiency in protein of up to 25 per cent, up to 30 per cent excess fibre and up to 25 per cent excess fat. Because of mortalities in stock, attention was drawn to the presence of mintweed (*Salvia reflexa*) in a consignment of lucerne hay. A total of 1,430 bales of this fodder was seized and a magisterial order obtained for their forfeiture and destruction.

New regulations were gazetted (i) requiring the actual content of fat and sodium chloride to be shown on the label instead of the maximum and minimum fat and the maximum sodium chloride, (ii) prescribing the maximum permitted levels of pesticides, (iii) requiring applicants to declare the level of any foreign substance present, and (iv) requiring pet food manufacturers to state on labels the species of animal from which meat was derived.

Stock medicines. — The Stock Medicines' Board dealt with 1,691 annual applications for re-registration and 206 new applications. Of these, eight were subsequently withdrawn while one was refused registration. As in previous years, the Board maintained close liaison with the Technical Committee on Veterinary Drugs and also with the Department of Public Health concerning the Poisons Act and its regulations.

Veterinary Surgeons' Act

Inspections were made to determine whether visiting cards and letterheads used by practicing veterinarians were printed in accordance with regulations. Some breaches were detected, the most important being the use of stationery in the name of companies instead of the veterinarians concerned. No prosecutions were launched on this account. On behalf of the Veterinary Surgeons' Board, a case of alleged misconduct by a veterinary practitioner was investigated.

Prosecutions

Of 24 prosecutions under the Stock Diseases Act or its regulations, 23 were successful. The offences were failure to affix tail tags to sale cattle, failure to notify the presence of sheep lice, attempting to sell lice-infested sheep, driving sheep affected with footrot along a public road and the illegal movement of cattle into a protected area.

A successful prosecution was undertaken under the Stock Foods and Medicines Act for the sale of a stock medicine which had been refused registration and another under the Swine Branding Act for the illegal use of another owner's pig brand.

MEAT INSPECTION SECTION

Staff

The establishment of the section consisted of one Principal Veterinary Officer, one Assistant Principal Veterinary Officer, one Veterinary Officer, one supervising Senior Meat Inspector and 230 Meat Inspectors — an increase of six Meat Inspectors in the year. There were no vacancies.

Ante-Mortem and Post-Mortem Inspections

At Homebush Saleyards, ante-mortem inspection of cattle was carried out on three days weekly when such sales were held, and of pigs on the one day each week when they were sold. Cattle were inspected on receipt at Homebush Abattoir, and all animals (including pigs, calves and sheep) were ante-mortem inspected on the day of slaughter at all works. Animals submitted for emergency slaughter were examined at all abattoirs before being killed. In some areas where facilities are provided, this service was extended to saleyards and private properties.

Post-mortem inspection was carried out at the time of slaughter at the State Abattoir, Sydney, at 26 other abattoirs in N.S.W. and at two small licensed meatworks near Sydney. Post-mortem inspection was also carried out on horses at one pet food knackerie.

Meat introduced to Sydney was re-inspected while the handling of meat at the Sydney Meat Markets was supervised. Smallgoods factories were regularly inspected and 820 inspections made of butchers' shops.

The total slaughterings at abattoirs where State Meat Inspectors are located are shown in the following table.

Slaughterings at Abattoirs Where State Meat Inspectors are Located

	Cattle	Calves	Pigs	Sheep
State Abattoir	138,840	58,911	194,377	2,013,521
Inside County of Cumberland —				
Local	21,533	13,848	56,726	479,001
Export	29,896	397	331	254,012
Country Areas —				
Local	595,875	103,082	561,133	5,314,721
Export	265,877	15,032	9,090	3,010,249

Slaughterings at knackeries were 3,125 horses and 2 cattle.

Carcass Condemnations

The following table shows the percentage of carcasses totally condemned and the reasons for condemnation:

	Cattle %	Calves %	Pigs %	Sheep %
Actinomycosis)				
Actinobacillosis)	0.002	—	—	—
Arthritis	0.015	0.069	0.414	0.062
Caseous lymphadenitis	—	—	—	0.316
<i>Cysticercus ovis</i>	—	—	—	0.016
Emaciation	0.033	0.022	0.010	0.185
Sarcosporidiosis	—	—	—	0.019
Septic conditions	0.021	0.020	0.024	0.008
Tuberculosis	0.036	0.002	0.016	—
Other conditions	0.142	0.221	0.116	0.108
Totals	0.249	0.334	0.580	0.715

Partial carcass condemnations are shown in the following table:

	Cattle %	Calves %	Pigs %	Sheep %
Actinomycosis)				
Actinobacillosis)	1.587	0.002	—	
Arthritis	0.319	0.016	0.622	0.125
Caseous lymphadenitis	—			0.170
Septic conditions	0.019	0.002	0.056	0.013
Tuberculosis	0.036		0.016	—
Other conditions	1.313	0.026	1.068	0.050
Totals	3.274	0.046	1.762	0.358

Apart from cattle reacting to the tuberculin test, lesions of tuberculosis were found in only 20 bovine carcasses, representing an infection level of 0.012 per cent. This compared with 0.014 per cent, 0.019 per cent, 0.027 per cent, 0.06 per cent and 0.09 per cent for each of the previous five years respectively.

Liver Condemnations

The following table shows the reasons for condemning sheep and cattle livers:

Cause	Cattle %	Sheep %
Liver fluke (<i>Fasciola hepatica</i>)	18.5	9.4
Hydatids (<i>Echinococcus granulosus</i>)	0.8	4.8
<i>Cysticercus tenuicollis</i>	—	18.3
Other parasites	—	1.0
Caseous lymphadenitis	—	0.3
Abscess	1.7	—
Telangiectasis	0.5	—
Adhesions	0.9	0.4
Pigmentation	—	0.3
Contamination	1.6	1.0

QUEENSLAND BORDER CONTROL

There were 68 inspectors employed full-time and 8 part-time to control introduction of stock from Queensland.

Stock Movements

Due to improved seasonal conditions in Queensland the number of cattle entering N.S.W. declined from 869,233 in 1969-70 to 622,483 and sheep from 3,041,509 to 1,037,928. The number of cattle entering Queensland increased from 182,157 in 1969-70 to 248,376 due to a shortage of fat cattle for slaughter in southern Queensland.

The following tables show numbers of stock which moved across the border between N.S.W. and Queensland.

From Queensland to New South Wales

Administrative Section	Cattle	Sheep	Pigs	Horses	Goats
Stanthorpe	67,231	7,398	26,738	1,135	591
Goondiwindi	480,542	820,527	813	8,456	20
West of Mungindi	70,175	209,439	—	2,532	341
Tibooburra	4,535	564	—	105	—
Totals	622,483	1,037,928	27,551	12,228	952

From New South Wales to Queensland

Administrative Section	Cattle	Sheep	Pigs	Horses	Goats
Stanthorpe	61,533	353,417	3,363	1,287	
Goondiwindi	183,067	908,881	11,130	1,114	
West of Mungindi	3,396	62,523	—	108	3
Tibooburra	380	—		6	
Totals	248,376	1,324,821	14,493	2,515	3

Constructional Work

Some 11 miles of replacement fencing were erected in various situations along the border. Three new cottages were constructed, two to replace cottages destroyed by fire. Twelve cottages and one office were renovated. Renovations were also made to six dips while gates at one crossing place were replaced.

General

A new stock yard complex at the Wallangarra meatworks on the border, enabled cattle from Queensland to enter the abattoir without passing through N.S.W., thereby considerably reducing dipping. Some changes were made in the schedules governing the introduction of stock from Queensland into N.S.W. to facilitate movement.

BOARD OF TICK CONTROL — CATTLE TICK CONTROL

Staff

The professional staff were the Chairman, two Veterinary Officers, a Deputy Chief Chemist (Tick) and two Chemists. There were 511 Ministerial staff employed at June 30, 1971 — the same number as at the close of the previous financial year. An additional 60 men have been requested for the Kempsey Quarantine Area. Extra staff are necessary to cope with ever-increasing traffic at quarantine gates, the building construction programme recently commenced and control measures in the areas where ticks resistant to organic phosphates have been found.

There were 191 transfers of staff between sections while a turnover of 53 resulted from retirement, resignation, death, termination of services, and transfers to other sections of the Department. It was difficult to engage sufficient suitable labour for some vacancies, particularly gatekeepers.

Eradication of Cattle Tick (Boophilus microplus)

Cobley's Quarantine Area. — Following the breakthrough of a bull from the Grafton Area to clean country, 140 acres on the western side of the Orara River was emptied of stock and leased for 12 months.

Hickey's Holding, Ti-Tree. — An area of 150 acres adjoining the clean country boundary at Ti-Tree near Tabulam, which had been emptied of stock for 12 months and released from quarantine last year, had to be requarantined due to a breakthrough of 65 cattle from the Tabulam Area.

Tick Fever

While 1970–71 was a favourable year for tick life, it seemed surprisingly unfavourable for *Babesia* spread judging by the incidence of babesiosis in N.S.W. The dipping programme was completed on the six holdings quarantined following tick fever outbreaks last year. There were no further losses and all holdings were released from quarantine. No other confirmed or suspected cases of tick fever occurred.

To safeguard the situation, staff continued to be vigilant for Queensland-bred cattle entering the Tick Quarantine Areas. It was surprising that the dramatic increase in acaricide resistance in cattle tick carried no associated tick fever problems.

The table below summarises tick fever outbreaks since 1967–68:

Area	1967–68		1968–69		1969–70	
	Holdings	Head	Holdings	Head	Holdings	Head
Kyogle	1	114	—	—	4	729
Tweed	2	213	—	—	2	136
Richmond	1	73	2	117	—	—
Woodenbong	1	701	1	271	—	—
Legume	2	135	—	—	—	—
Bonalbo	—	—	2	611	—	—
Totals	7	1,236	5	999	6	865

Note: There were no new cases in 1970–71

Control Policies

The policy of strategic dipping was implemented east of the Richmond Range and re-introduced west of this Range after the Board of Tick Control and the Cattle Tick Control Commission recommended that the previous policy of examination of stock instead of dipping be abandoned.

Areas east of the Richmond Range — The dipping programme, scheduled to begin in September, was postponed until October in the Tweed and Bangalow areas and until November elsewhere on account of drought. This delay meant a reduction to four compulsory treatments in all but Tweed and Bangalow Areas. In the last round, 553,980 cattle were dipped and 4,687 examined.

The movement of stock to dips along busy roads still presented a problem and led to increasing pressure to have spray races accepted as an alternative to dipping on some holdings. Amalgamation of properties, land improvement, changes in animal husbandry and intensification of farming created demands for extra dips or the alternative use of spray races. The re-routing of many roads also created many dipping problems.

An increase in tick infestations east of the Richmond Range, particularly in the Kyogle Area where the resistance problem was greatest, is shown in the following table.

Areas	Number of Infestations Detected				
	1966-67	1967-78	1968-69	1969-70	1970-71
Richmond —					
Bangalow	3	18	4	5	3
Lismore	2	3	1		
Nimbin	7	10	—	1	—
Casino	12	14	1	—	7
Rappville	—	1	—		—
Kyogle	3	7	11	11	21
Tweed	—	1	4	3	1
Totals	27	54	21	20	32

Areas west of the Richmond Range — The old policy of four compulsory dippings of all cattle in the Tabulam, Bonalbo, Woodenbong and Legume Areas was reverted to. Under this policy, 12 infestations were recorded compared with 29 under the policy of examinations in the previous year. The difference is believed to reflect the fact that infestations of a low order can be detected if ticks are searched for at a time when regular treatments are not assisting to conceal them.

In the Cullendore and Boonoo Boonoo Areas, a policy of examining stock when they were mustered for station purposes was implemented. Special attention was given to holdings previously infested and to the adjoining properties. No evidence of cattle tick was found. Preliminary studies were made of the cost of an eradication campaign in these two areas compared to the cost of the control measures. The boundary of the Cullendore Area was redrawn to embrace two properties on which light infestations had been detected the previous year.

Infestations in the Areas west of the Richmond Range from 1966-67 to 1970-71 were:

Areas	Number of Infestations Detected				
	1966-67	1967-68	1968-69	1969-70	1970-71
Bonalbo	2	9	16	13	6
Tabulam	5	2	1	6	2
Woodenbong — Legume	7	—	—	10	4
Cullendore	—	1	6	—	—
Boonoo Boonoo	—	—	—	2	—
Totals	14	12	23	31	12

Grafton and Copmanhurst Areas — A policy of examinations on as many holdings as possible was commenced. In the Grafton Area, 45,662 cattle were examined on 527 out of 1,430 holdings and in the Copmanhurst Area 41,858 animals were examined on 171 out of 226 properties.

No infestations were detected in the Copmanhurst Area but a report of ticks by the owner of a property at Eatonsville in the Grafton Area was confirmed. There had been no previous history of infestation on this property and the only recent introductions had been a few bulls and cows from the Grafton and Copmanhurst Areas. A check on the properties from which they had come failed to reveal any evidence of ticks. Three adjoining holdings, and the Eatonsville Village Reserve were also classed as infested due to bad boundary fences. Ticks were later found on one of these holdings.

Ticks collected from this area proved to be of the Ridgeland resistant strain. It was difficult to explain the resistance because routine dipping had not been practised in the area.

Kempsey Area — At the close of the year, cattle ticks were found in clean country 100 miles south of the existing quarantine Areas. The finding caused considerable consternation. The infestation was discovered when a bull carrying a heavy burden of cattle ticks was unloaded at Byron Bay Abattoir. Tracing back from the tail tag established with certainty the property of origin. Quarantine

restrictions were imposed on the infested holding and on many others implicated by stock movements. An eradication policy was planned for this area, involving the construction of three dips to serve the infested and adjoining holdings, plus a further dip at the saleyards to treat moving stock. The source of the infestation had not been traced at the end of the year.

Policy for infested holdings – Policy at the beginning of the year required stock on infested holdings to be dipped four times at 21-day intervals, followed by four examinations at the same intervals provided no ticks were found after the first dipping. However, the Board of Tick Control recommended that the number of dippings be extended to six, with two examinations to follow. Subsequently, the policy approved was six dippings at 21-day intervals, followed by two examinations at the same interval, provided no ticks were found after the third dipping.

Acaricide Resistance in Ticks

The incidence of infestations due to ticks of multi-resistant strains increased significantly. The policy adopted was to declare such properties and those adjoining as special quarantine areas and to require all stock therein to undergo a ten-month programme of tick eradication. However, following a recommendation by the Cattle Tick Control Commission, parts of some adjoining holdings were exempted from the conditions for resistant ticks. These exemptions were confined to larger holdings where fences and management would permit the concessions within the limits of safety. They maintained reasonable control without unduly punitive conditions.

At the close of the year, there were 16 special quarantine Areas, six Areas having been released during the year. Of those remaining, seven were in the Kyogle Area, one in Tabulam, one in Bonalbo, one in Woodenbong, five in Richmond (one Bangalow, three Casino, and one Lismore), and one in Grafton. These areas involved 37 infested holdings with 6,700 cattle and 125 adjoining holding with 10,900 cattle.

Currumbin Valley - Queensland

The dipping programme was continued in the Currumbin Valley on a voluntary basis, in co-operation with the Queensland Department of Primary Industries. Excellent control was achieved by strategic dipping at 21-day intervals. The programme was completed with the tenth round of treatments in April, except on seven holdings that had a history of continuing infestation and on which treatments were continued until the middle of June.

When the programme was commenced in 1969, four of approximately 50 properties had ticks showing Biarra resistance. Since then only two more cases of this type of resistance have been detected, indicating a low rate of spread and also indicating that repeated dippings did not encourage tick resistance. The programme has resulted in most of the 50 holdings being free of cattle ticks for a considerable period, 15 of them for 18 months.

Inspection of Stock at Abattoirs

Examinations were continued at Grafton, Casino, Byron Bay, Macksville and Tenterfield abattoirs, but the only cattle ticks found were on an unidentified calf at Casino abattoir, and on the Kempsey bull referred to previously.

The Assistant Inspector at Tenterfield abattoir continued to supervise the unloading of cattle sent by rail from Queensland and the dipping of all ex-Queensland calves before slaughter. He also supervised the issue of certificates for hides leaving the abattoir and examined cattle at the Tenterfield saleyards for ticks.

The slaughter of cattle introduced from clean country was supervised at the Casino, Byron Bay and Grafton abattoirs.

Examinations in Clean Country

Mobile inspection teams again operated during late summer and autumn in clean country, south of the Grafton Quarantine Area. A total of 139 holdings were included in the survey and 15,737 head of stock examined. No cattle ticks were found.

Fencing, Dip and Building Construction

Approximately 17½ miles of new fence was erected, 34 miles of existing fence was repaired on the external and internal quarantine boundaries, 7 new dips were constructed and 373 dips and dip yards were repaired. Gravel was applied to 103 dip yards.

The appointment of a Clerk of Works to plan and undertake improvements in accommodation and amenities was a major advance. A survey was made of all cottages and camps and priorities established. A maintenance programme was commenced with emphasis being placed on drainage. The installation of septic systems in certain residences was approved. A suitable design for new cottages was discussed with the Architect's Branch. Plans were prepared and are being priced with Sydney and local construction firms.

Eight new huts and six tent units were constructed and repairs effected to 12 cottages, 7 huts, and 14 tent units. In addition, four tent units were roofed with galvanized iron. A new office was completed at Woodenbong.

Mortality Associated with Dipping

Compensation amounting to \$10,166.03 was paid for the loss of 299 head of stock. Of these, 235 were poisoned and 64 died from misadventure.

It was estimated that the mortality rate of delnav and ethion was 2.17 and 2.50 respectively per 100,000 head of cattle dipped. A few heavy losses in dursban were recorded but insufficient numbers were dipped to allow losses per 100,000 head to be determined. The practice was continued of collecting renal fat samples for analysis where organic phosphate poisoning was suspected; 58 samples were analysed for delnav, 103 for ethion and 15 for dursban. The analyses assisted in establishing the cause of death.

Board of Tick Control Laboratory

A great number of analyses were carried out to ensure efficiency in dipping and to monitor residues in tissues, butter, milk fat, fish, soil and water.

Acaricides Used

The numbers of dips charged with the various acaricides were: delnav 713; ethion 670; dursban 56; sevin 4; and nexagan 1. In 23 dips chlorphenamidine was used as an additive with the existing acaricide.

Cattle Marking Paint

The amount of cattle marking paint made at the Board's laboratory for use by inspectors was 1,097 gallons, an increase on the 888 gallons manufactured the year before. The paint is cheaper and superior to that available commercially.

COMMONWEALTH QUARANTINE ACT

The Division of Animal Industry continued to administer certain sections of the Quarantine Act 1908-69 for the Commonwealth Government. Two Veterinary Officers, one Senior Port Inspector and sixteen Port Inspectors now do the animal quarantine work at Sydney and Port Kembla. The District Veterinary Officer and one Port Inspector do the work at Newcastle.

Animal Imports

Total prohibition remained on imports of sheep and goats into Australia. The ban on the imports of dogs and cats from the United Kingdom and Ireland, imposed in October 1969 because a case of rabies occurred in England outside a quarantine station, remained in force for the whole year.

Imports of cattle, horses, pigs, birds, day-old poultry and laboratory animals increased, particularly imports of cattle from New Zealand. Dogs, cat and queen bee imports decreased slightly. Cattle semen introduced from the United Kingdom and New Zealand increased threefold over the previous year; 21,951 doses were imported.

Seven attempts to smuggle animals from overseas by air and one by sea were detected - 22 birds, one dog and one monkey were involved. Only two cases were organized, the others were associated with family pets.

A number of prohibited species such as anemone, star fish and crabs, were imported with regular shipments of aquaria fish. Importers were warned that the term "fish" did not include other forms of marine or estuarine life.

Imports of Animal Products

Imports of chilled meat, fish products, furred skins, animal hair and fish meal increased. Shipments totalling 34¼ million lb of fish meal from Chile accounted for the considerable increase in the quantity of this material imported. Imports of tinned meats, casings, cheese, hides and skins, hide pieces, wool, feathers and stock feeds decreased. For the second year in succession no meat meal was imported from New Zealand.

There were 13 consignments (262,531 lb) of frozen boneless meat of Australian origin returned from U.S.A. after being refused entry. A consignment (167,529 lb) was also returned from Canada. The total was two and a half times that returned in 1969-70.

Passengers' Baggage

Co-operation with customs officers continued in searching for illegal goods in the baggage of passengers arriving by sea and air. Seizures of the main items included 4,595 lb of meat, 1,993 lb of cheese, 1,804 lb of trahana and 931 eggs. Meat was the only item for which seizures increased.

Disinfection of footwear and work clothes brought by incoming air passengers, who had been associated with rural industries in countries where foot and mouth disease exists, continued. Some 2,841 pairs of shoes were disinfected and eleven clothing articles detained for laundering from 1,644 such passengers. This was less than in the previous year.

Passenger arrivals were 628,269 by air and 95,319 by sea, compared with 641,950 and 106,585 in 1969-70. The decrease in passengers arriving by air was the first since 1959, when records were first kept by this Division. The baggage of service personnel returning to Australia from overseas were submitted to the same examination as that of civilian passengers although very few seizures were made.

Parcels Post

The volume of goods arriving from overseas by parcels post and subject to quarantine control remained constant. Centres of introduction were Sydney, Newcastle, and Port Kembla. Many items of exotic food of animal origin were seized, the more significant being 811 lb of meat, 140 lb of cheese, 104 lb of noodles and 47 eggs. Misleading or false customs declarations on parcels were of concern as they added to the difficulty of discovering prohibited materials. The incidence of falsely labelled tins containing meat products was as great as in previous years.

Trade samples, imported for analytical examination, were permitted restricted entry to enable local manufacturers to study and keep abreast of overseas developments.

Supervision of Ships' Pets

Supervision of pets on overseas vessels visiting Sydney and Newcastle remained strict. On a number of occasions ships' officers were instructed to tighten precautions against escape. No ship Master's bonds were estreated during the year. Following the refusal of the master to sign a bond, three dogs, nine cats and two rabbits were destroyed; seven chickens were destroyed as their presence on a vessel contravened quarantine legislation.

Export of Animals

Control over the export of animals involved inspection and sometimes supervision of treatment as required by an importing country. The export of sheep increased primarily because of a consignment of 1,030 Corriedales to India and the shipment of some 200 Merino rams to a number of overseas countries. Horse, goat, pig and cat exports also increased.

Poultry exports decreased considerably due mainly to a great reduction in the export of day-old chickens to Fiji. Dog exports decreased for the first time for many years. Shipments were consigned to 44 countries and totalled 2,720 animals. The main exports were 779 to U.S.A., 380 to New Zealand, 354 to Hong Kong, 330 to Guam, 226 to New Caledonia and 211 to Indonesia. The export of poultry, cattle birds, fish and zoo animals also decreased.

LIVESTOCK HEALTH — RESEARCH

Veterinary Research Station, Glenfield

General

Increasingly heavy diagnostic commitments with no increase of staff at the District Veterinary Laboratories, and only a small increase at Glenfield, restricted research programmes. Lack of high security isolation facilities restricted work on virus diseases of poultry.

Liaison was maintained with other State Departments of Agriculture, CSIRO, the Commonwealth Serum Laboratories, Commonwealth and State Departments of Health and a number of commercial organizations.

Professional Staff

Professional staff as at the end of the year, consisted of a Director of Veterinary Research, a Principal Veterinary Research Officer, an Administrative Officer, two Assistant Principal Veterinary Research Officers, five Special Veterinary Research Officers, ten Veterinary Research Officers, two Chemists, two Research Officers, four Senior Medical Technologists, one Medical Technologist, five Technical Officers (Scientific), 12 Technical Assistants (Scientific) and a Librarian.

Buildings and Equipment

Plants were nearly completed for the establishment of a third district veterinary laboratory at Wagga which it is hoped will be functioning by late 1972. Plans were also prepared for a separate brucellosis and tuberculosis annex at the Veterinary Research Station, Glenfield, to enable the increasing volume of specimens for these diseases to be examined in greater security. Preliminary planning was undertaken for 12 isolator cages at the Veterinary Research Station, Glenfield for Marek's disease research, using funds to be provided by the Chicken Meat Research Committee. A prototype cage is being built by the Department's Agricultural Engineering Unit. The construction of a new cottage at Glenfield was nearly complete while a combined carpenter's workshop, animal attendant's quarters and bulk store were constructed. Renovations and improvements were made to a further cottage, the parasitology wing, the packing room and a bottle washing room.

A Technicon dual channel autoanalyzer was purchased for use in complement fixation testing.

Bovine Brucellosis

Complement fixation test (CFT): — The value of the CFT in distinguishing between serum reactions due to infection and those due to vaccination was clearly demonstrated. Studies showed that virtually all uninfected cattle have lost their CF titres within 6 to 12 months of vaccination with Strain 19 regardless of the age at vaccination. Consequently this test is now extensively used despite the problem of prozone reactions which occur when employing a CFT system requiring incubation at 37°C. This problem may largely be overcome by employing overnight fixation at 4°C, but use of such a system on a large scale is impractical at present.

Acidified antigen serum plate test. — Following overseas reports of the value of this test employing an antigen stained with Rose Bengal (RBT), two antigens were examined, one stained with Rose Bengal and the other with Crystal Violet (CVT). Comparison of the results of the serum agglutination test (SAT), CFT and RBT and CVT confirmed the value of the acidified antigen serum plate test for screening purposes. It was decided to use the test with Rose Bengal stained antigen on all sera obtained at abattoirs for survey purposes. The test has been modified slightly so that 0.025 ml of serum and antigen are mixed in 80-well haemagglutination trays. The trays are rocked gently on an "Analite" rotary agglutinator for 3½ minutes and the tests are read over an illuminated acrylic plate. This system enables one operator to perform up to 200 tests per hour. The results were comparable to those obtained by using the field kits provided by the antigen manufacturers.

Contagious Bovine Pleuropneumonia (CBPP)

The CBPP survey was terminated towards the end of the year. During the last two and a half years of the survey more than 57,000 sera were tested in the CFT and only 50 gave positive reactions. With one exception, when it was possible to rebleed these animals they became negative within three to six weeks of the positive sample being collected. The animal whose sera did not become negative was slaughtered but showed no evidence of CBPP. The very low "false" reactor rate (0.1 per cent) is extremely satisfactory and adequately reflects the freedom of this State from CBPP. Most sera from the reacting animals have been forwarded to CSIRO for further investigation.

Internal Parasites in Cattle

The continuing project on internal parasites of cattle, supported by the Australian Meat Research Committee, aims to determine seasonal patterns of fluke and worm infections in cattle in various areas and to assess their economic significance. The project is now moving into a phase involving evaluation of parasite control programmes under field conditions. Studies were continued on the central and southern tablelands and slopes. Routine faecal examinations and total worm counts were supplemented by observations on pasture larval populations.

In the New England region, arrested larval development in *Ostertagia* infections was observed in autumn-born beef calves, during the spring-summer period when they were five to eight months old. Arrested larval development had been seen previously in yearling cattle at this period. In contrast, very little arrested development of *Ostertagia* infections was seen during spring on two coastal properties near Sydney. Arrested development of *Ostertagia* has been seen regularly in other parts of the State, but the conditions governing its occurrence have not been defined as precisely as those in the New England region.

Evaluation of programmes of parasite control in weaner beef cattle began at Casino, Grafton and Wagga, involving comparison of three winter anthelmintic treatments, commencing at weaning, and/or movement to summer-autumn spelled pasture at weaning. Dry autumn-winter conditions necessitated supplementary feeding on two of the properties.

A grazing management programme for the control of *Ostertagia* infections in yearling cattle was evaluated for a second year on two New England properties. Results were inconclusive — on one property pasture larval counts on the contaminated paddock were low during spring owing to a previously short autumn contamination period; on the other the trial was not commenced until mid-spring and by that time both groups of trial cattle carried substantial worm burdens.

Monthly anthelmintic treatment of heifer calves on north coast dairy farms during the high rainfall months from October-March gave a bodyweight advantage of from 3 to 20 kg over undrenched controls on four properties. Similar studies are planned for next year.

Regular observations on liver fluke (*Fasciola hepatica*) infections in cattle on a number of trial properties again showed very light levels of infections. Despite these apparently low fluke burdens, cattle receiving monthly fluke anthelmintic treatment showed a small bodyweight advantage over untreated animals.

Laboratory infection of calves 7 to 13 months of age with 500 *Fasciola hepatica* metacercariae resulted in 45 per cent of the total fluke burden being still in the liver parenchyma 12 weeks after infection. Administration of rafoxanide was highly effective against all flukes present, whereas oxcylozanide was effective only against stages in the bile ducts.

Internal Parasites in Sheep

Studies with lambs on irrigated pasture at Berrigan were continued. They incorporated a comparison of performance under two programmes of anthelmintic treatment at two stocking rates. Monthly-treated lambs performed better than untreated lambs although worm burdens of *Haemonchus*, *Trichostrongylus* and *Nematodinus* were generally low until the latter part of the observation in March-April, when *Fasciola* burdens also increased. Lambs at 37 per hectare made better weight gains than those at 49 per hectare and further trial work is proposed to determine optimum stocking-rates in this situation.

Studies on the epidemiology of fascioliasis in sheep during summer irrigation continued at Leeton Agricultural Research Station. Despite heavy contamination of trial paddocks with *Fasciola* eggs, few fluke snails were present in the area and pick-up of metacercariae by tracer sheep was negligible.

Experiments comparing the response of drug-resistant strains of *Haemonchus* and *Trichostrongylus* to thiabendazole and parbendazole were completed. The LD₅₀ of thiabendazole for four strains of *Haemonchus* lay between 60 and 180 mg per kg, while that of parbendazole was between 18 and 40 mg per kg. Thiabendazole had LD₅₀ values of 70 and 125 mg per kg and parbendazole between 25 and 40 mg per kg against two strains of *Trichostrongylus*. These figures represent a many-fold increase over LD₅₀ values against strains of these parasites susceptible to the two anthelmintics.

Encephalomyocarditis (EMC) of Pigs

Identification of the original isolate was confirmed by cross-neutralization tests against an introduced reference strain. Further EMC virus isolations were made from both field specimens and from experimental material by the inoculation of cell cultures. Routinely, foetal mouse fibroblast (FMF) cultures were used for this purpose. These cells were used stationary and were preferred to L cells, a cell line of mouse origin.

Examination of sera for EMC antibody for field survey and experimental purposes was by haemagglutination inhibition and occasionally, by neutralization tests. Application of these techniques showed that a considerable proportion of herds may be infected without showing clinical signs, especially among more mature animals. Apart from pigs showing the typical myocarditis and associated lesions, virus recoveries were made from mice and rats caught on properties where pigs were diseased.

Attempts were made to describe the epidemiology of the disease on one property which was well run and on which pig mortalities continued for 12 months. There were difficulties in tracing pigs but it was possible to identify some cases of active and some of resolving disease in apparently normal pigs being slaughtered. In one case, high titres of virus were recovered from heart and blood serum of a pig showing no gross or histological heart lesions. It was also from this property that most of the virus recoveries from rodents were made.

Trials were conducted to reproduce the disease in pigs by intra-muscular injection and by oral exposure. Injection of virus doses from 10^2 to 10^6 tissue culture infective doses 50 were consistently successful and illness was almost invariably fatal. Oral exposure was much less reliable except when the carcasses of mice, experimentally infected by intra-peritoneal injection of virus, were fed to pigs. The latter trial resulted in all four exposed pigs dying of acute cardiac disease within five days.

Ephemeral Fever

Two virus recoveries were made by transmission in cattle during the statewide epizootic (described in the section Livestock Health — Field Activities). Further attempts at virus isolation by more convenient, economical and practicable methods were deferred until cell culture systems could be established and infected by known reference and adapted strains. To this end, and also to allow a collection of about 700 sera to be examined by serum neutralization tests, suitable baby hamster kidney cells and adapted virus were introduced from CSIRO. Baby mouse brain adapted virus was also introduced from the Queensland Institute of Medical Research. Work with these materials reached a point where a suitable cell/virus system became available to enable examination of freeze-stored material to proceed. Specimens from the acute dyspnoea — sudden death syndrome — which occurred concurrently with ephemeral fever in some herds, were included in the stored material.

Equine Encephalitis

Indications of encephalitic disease in horses were reported in late summer-autumn. No viral agents were recovered from the few, almost invariably unsuitable, specimens received. Sera from supposed cases were referred to the reference laboratory, Australian National University, Canberra. Antibodies and boviruses, both groups A and B, were found but further analysis is required before these results can be properly interpreted either in relation to particular cases or to epidemiological trends.

Mucosal Disease

Mucosal disease virus was isolated from typical bovine cases. A mucosal disease virus from sheep in a flock suspected of being involved in an outbreak of hairy shaker disease (Border disease) was transmitted to experimental sheep. Recipient sheep consistently developed mucosal disease precipitating antibody. Some either aborted or gave birth to weak and hairy lambs.

Sheep Pneumonia

Observations on selected strains of Border Leicester sheep at Cowra Agricultural Research Station continued to provide evidence that there is an inherited predisposition to the disease. There were statistically significant differences between the strains when lambs were raised in close contact. This may reflect a genetic basis or a vertically transmitted infectious agent. Examination of sera from the 1971 slaughter group showed no evidence that *Chlamydia* were involved in the pneumonia.

Mycobacterial Infection in a Lamb

Granulomatosis lesions were present in the intestine and mesenteric lymph node of a lamb. Organisms fluorescing with auramine O stain were plentiful in the lesions. Sheep experimentally infected by intravenous inoculation of the organism had similar lesions and numerous organisms widely distributed in their bodies. Experimental infection by the oral route was commended.

Newcastle Disease Virus (NDV)

NDV was recovered on one occasion from specimens submitted for suspected infectious bronchitis. The isolate was examined for virulence in day-old chicks exposed directly and by contact. No clinical disease occurred although serological examinations showed that infection had occurred and had been transmitted by contact. Virus recoveries were made from organs of chickens sacrificed and tracheal lesions were demonstrated in one such chicken. As with a 1967 isolate, dwarfing of inoculated chicken embryos occurred and this appeared to be an effect of the NDV. No contaminating infectious bronchitis virus could be demonstrated.

Marek's Disease (MD)

In vaccination studies, with over 2,000 birds and using attenuated MD virus, with which Mr. C. A. W. Jackson was associated while in the United Kingdom, the percentage mortality from Marek's disease between the 9th and 32nd week of age was 44 per cent in the non-vaccinated birds and 12 per cent in those vaccinated. Two epidemiological studies are being assessed. Turkey herpes virus is being examined for safety and its immunogenicity against artificial infection with MD virus.

Specific Pathogen-Free (SPF) Flock

A self-contained hatchery was constructed from funds provided by the Commonwealth Egg Marketing Authority. Chickens have been reared for experimental work on Marek's disease. A continuous through-put of chickens is planned for 1971-72 to produce SPF stock for research work and to replace the existing breeding flock.

Infectious Laryngotracheitis

In co-operation with officers of the University of Sydney and the National Biological Standards Laboratory, a dose/response project was established to evaluate the effective vaccinating dose of SA2 virus administered via the drinking water. Challenge of birds has been completed confirming the desirable dose rate to be 1×10^4 pock forming units per bird. Sera collected prior to and after challenge are being assayed for comparison with challenge results.

Pullorum Disease

Most of the studies commenced in 1966 have been terminated. However, work has proceeded in co-operation with the International Laboratory for Biological Standards of the World Health Organization in the standardization of agglutinating antisera for *Salmonella pullorum*. The standardization of stained pullorum antigen was examined in conjunction with the National Biological Standards Laboratory.

Mortality Survey at Poultry Research Station, Seven Hills

Some 1,498 carcasses were examined in a mortality survey at the Poultry Research Station during the last six months of the year. Most important diagnoses were Marek's disease — 11.8 per cent of carcasses, infectious bronchitis — 9.5 per cent, starvation — 9.0 per cent, egg peritonitis 5.7 per cent, chilling — 5.6 per cent, nephritis — 5.0 per cent and lymphoid leucosis — 4.9 per cent. The most common infection was Marek's disease. With the aid of histopathology, it was readily differentiated from lymphoid leucosis in those birds 16 weeks of age or more. The incidence of visceral tumors was high constituting about 85 per cent of all cases of Marek's disease.

Nephritis and urate nephrosis were the most prevalent organ pathology encountered both in brooder chickens and in older age groups. Carcasses displaying dark dehydrated muscles, water nephrosis with or without lower tracheal involvement and ureters packed with water, allowed a presumptive diagnosis of infectious bronchitis virus infection. However there were a significant number of cases of nephritis which were sometimes accompanied by visceral gout. Much has yet to be learned of the complex aetiology of this pathological condition; environmental stress may be one of the common agents.

Broiler Mortality Survey

Two broiler mortality surveys in July, 1970, involved one shed of 4,000 birds and one of 4,500 birds at the Poultry Research Station. Autopsies were carried out in all dead birds submitted. In both surveys, infectious bronchitis, yolk sac/navel-infection and leg abnormalities (osteodystrophy, osteomyelitis and perosis) were the most frequent disorders.

Biochemical Parameters in Sheep

As a result of observations in this project, the significance of changes in serum alkaline phosphatase (SAP) activity was investigated. In new born lambs, SAP activity increased rapidly after birth and 24 hours later was approximately double that at birth. This increase was found to depend on the lamb feeding. Activity remained low in lambs fasted for 12 hours, but rose once the lambs were returned to the ewes. It was shown that the increased activity in fed lambs originated from the intestinal tract.

SAP activities increased in lambs 4 and 16 months old when their nutritional conditions improved after a period of nutritional stress.

The effect of variation of dietary intake upon SAP activity in lambs was investigated in conjunction with the Livestock Research Section. A close relationship existed between SAP activity and bodyweight. Further investigation is warranted.

Pimelea simplex Poisoning

Feeding dried, ground desert rice flower (*Pimelea simplex*) to calves at low dose rates produced symptoms typical of St. George disease which occurs only in the far west of N.S.W. The cause of this disease has been the subject of speculation since the first investigations in 1938. Fresh *Pimelea* has a distressing smell and is not normally eaten. It may be eaten in small amounts mixed with other herbage when it is dry, after standing from the previous season.

Fresh *Pimelea* was dried, ground and administered as a drench. A single intake of 0.1 per cent of bodyweight induced a fatal dysentery. Repeated lower levels of intake produced diarrhoea and an accompanying loss of bodyweight. Two animals receiving a weekly dose of 0.02 per cent of bodyweight died after 16 weeks. During this period there was variable subcutaneous oedema characteristic of St. George disease. At autopsy, the peculiar liver lesion, peliosis hepatitis, was present, supporting the evidence that St. George disease had been reproduced and that *Pimelea simplex* could produce the syndrome.

Vitamin A

Plasma and liver levels of vitamin A were determined in groups of sheep affected by clinical deficiency in a drought feeding experiment. Response to treatment and to a period of grazing was also determined. Further information was also obtained from investigation of vitamin A and calcium deficiency in another experimental group. A modified method of vitamin A analysis was developed using trichloroacetic acid for colorimetric determination.

Hypomagnesaemia

Preliminary examinations have established that there is little variation between sampling sites in heart muscle, and that normal hearts (from abattoir-killed cattle) contain approximately 95m/eg/Mg/Kg (fat-free dry matter). These figures are about 10 per cent higher than those published overseas, apparently due to a more efficient extraction technique. Further assessment of the usefulness of this measurement for diagnosis, and the establishment of criteria for interpretation, have been continued by examination of samples of heart, serum and urine from normal and affected animals in the field and at abattoirs.

Liver Biopsy

The desirability of obtaining multiple sequential samples of liver from individual animals for studies on changes in levels of minerals, vitamins and other components, requiring samples of up to 20 grams, led to the examination of the practicability of abdominal surgery. Serial liver samples were taken from sheep by electrocautery to control haemorrhage. However, removal of several conical samples from the border of the ventral lobe resulted in vascular interference to adjoining areas, with severe necrosis. It appears that this approach will be suitable only for one or two samples over a short period.

NOXIOUS ANIMAL RESEARCH

Appointment of a second research officer to the noxious animals section allowed expansion of the programme to include research on the feral pig. The section studies the biology of feral and native animals which pose a threat to agriculture and develops and examines methods of control. The species under investigation are: the European rabbit (*Oryctolagus cuniculus*); the red fox (*Vulpes vulpes*); the dingo (*Canis familiaris dingo*); the feral goat (*Capra hircus*); the house mouse (*Mus musculus*); and the feral pig (*Sus scrofa*).

Rabbit Control

During summer, trials in association with Pastures Protection Board field officers in various parts of the state compared pellets with carrots as bait for sodium fluoroacetate (1080). Pasture cover varied from high dry feed to a short green pick and rabbit densities were generally high. The baits were similarly effective in all but one trial. In the exception, over 350 points of rain fell during the trial, and the population reduction was greater with carrots than with pellets.

Close co-operation was maintained with the Division of Wildlife of CSIRO and with the National Parks and Wildlife Service in relation to control in the far west of the State. Warren surveys were used as population indices to determine the efficacy of the "tarbaby" poisoning techniques in which 1080 poison incorporated in lanolin or grease is squirted into burrows. The trials were promising. Work commenced on a large area control programme including both warren ripping and "tarbaby" poisoning.

Because best results from 1080 are obtained when poisoning is carried out in the non-breeding season, rabbit inspectors and rangers are being assisted in processing information they obtain on the breeding condition of rabbits each month.

Dingo Research

Blood samples were collected for examination for enzymes and proteins by the staff at the School of Human Genetics of the University of N.S.W. The purpose is to determine whether genetic differences are present in dingo populations in different areas of the state.

Feral Goats

Feral goats are widespread in N.S.W. Control in much of the western area is comparatively simple but is virtually impossible in heavily timbered gorge and mountain country. A study of the behaviour, movement and fodder of the feral goats in one of these areas was commenced.

Feral Pigs

A study of the nature of the populations and distribution, habitat requirements and possible methods of control of feral pigs was begun. These animals appear to be widespread and numerous over a large area of this state, often occupying areas of difficult access. Current unco-ordinated control measures seem to have little effect on large populations. Four areas were selected as study sites, each representing a different type of habitat. Sampling of pigs was commenced in some areas. Type, colour, weight, breeding state, and morphometrics of all animals collected are being recorded. Methods of ageing pigs in the field are being investigated — eye lenses and canine teeth may be useful. The disease status is being assessed at autopsy and by the examination of blood sera and specimens in the laboratory.

Small Animal Colonies

The rabbit colony reached the stage of providing 250 to 300 rabbits per annum. No serious health problems were encountered. There was an outbreak of salmonellosis in the guinea pig colony, but the problem was overcome with improved hygiene. The mouse colony was moved into new quarters and an investigation commenced into causes of mortality. The colony is still a closed one and the animals are being randomly bred.

COLIN BLUMER DISTRICT VETERINARY LABORATORY — ARMIDALE

Professional Staff

Professional staff consisted of an Officer-in-Charge, two Veterinary Research Officers, one Senior Medical Technologist, one Technical Officer (Scientific) and two Technical Assistants (Scientific).

*Bacteriology and Pathogenesis of *Histophilus ovis* and *Actinobacillus seminis**

The growth and biochemical characteristics of 12 strains of *Histophilus ovis* and five of *Actinobacillus seminis* were compared. The work supported the hypothesis that they are two distinct organisms with, in part, different pathogenic roles in the genital organs of sheep.

Ovine Helminthosis

The parasite burdens and the possibility of control by strategic drenching were studied on a property rearing fat lambs on irrigated pastures. The property had a serious parasitic problem. Stocking rates were high with up to 75 ewes and lambs per hectare.

Studies continued into the third year on the incidence of internal parasites and their control by strategic drenching on a property with a marginal problem. The trial is to provide data on the likely parasitic burdens and their pathogenic effects. The information will have wide application in the area covered by this laboratory.

Muscular Steatosis

Samples of muscle were examined from a number of cases of muscular steatosis detected at abattoirs. Most were in cattle and, in addition, a number of interesting but probably unrelated conditions were seen in both cattle and pigs.

Copper Deficiency Survey

This survey based on copper analyses performed at the Veterinary Research Station, Glenfield, on the livers of locally slaughtered cattle continued.

DISTRICT VETERINARY LABORATORY — WOLLONGBAR

Professional Staff

Professional staff consisted of an Officer-in-Charge, two Veterinary Research Officers and a Technical Officer (Scientific).

Bovine Brucellosis

Brucella abortus was recovered by bacteriological culture from 3 per cent of 1,378 cows in 28 herds. The complement fixation test gave a low level of false negative and inconclusive reactions and was considered to be the most accurate of the serological tests investigated. The rose bengal test and the crystal violet test gave reasonable results with low levels of false negative reactions but moderate levels of false positive results. These tests, would be very useful as screening tests because they are easy but they would not be sufficiently accurate for use as a single diagnostic test. The serum agglutination test and the milk ring test on individual cows gave large numbers of inconclusive reactions. This limits their diagnostic usefulness.

Milk ring tests on bulk milk correlated well with demonstrated infections in herds and with the incidence of reactors to the complement fixation test. This indicated its considerable usefulness even in areas where strain 19 vaccine had been used rather indiscriminately. In this test, strong positive reactions were significant but weaker reactions were of little use for diagnosis.

Many herds had no reactors or only a very low level of reactors to the complement fixation test while giving higher levels of positive and inconclusive reactors to the other tests investigated. Herds with demonstrated infection, with or without reported abortions, usually gave distinctly higher levels of reactors to all of the tests than culturally negative herds.

Bovine Helminthosis

An investigation of the helminth status of calves on four north coast dairy farms and their response to intensive anthelmintic treatment was commenced. There was a considerable liveweight advantage in the treated calves on some farms.

Isolation Techniques for Salmonella spp

The value of various selective and enrichment media for the recovery of *Salmonella* spp. from calves and pigs was investigated. The most satisfactory were Rappaport's enrichment media and brilliant green agar (R.I.V. Modified, Oxoid) especially in combination.

CATTLE TICK RESEARCH STATION – WOLLONGBAR

Professional Staff

Professional staff consisted of a Director, a Special Veterinary Research Officer, three Research Officers, one Technical Officer (Scientific) and one Technical Assistant.

Cattle Tick Life History Studies

Life history studies of the cattle tick (*Boophilus microplus*) with weekly exposures of engorged female ticks were continued at Wollongbar (on a north easterly pasture slope and under scrub) and at Tabulam (on pasture and under forest). Successful hatchings of larvae from exposures of adults in humidified containers in Stevenson screens were compared with field exposures. The comparison showed that lack of humidity in winter can be a more important limiting factor than low temperature in the production of larvae by adult ticks.

The extreme dryness of the winter at Tabulam in 1970 (June to August rainfall was 1.07 inches) apparently contributed significantly to the adverse field conditions as there were more successful hatchings in humidified containers than in the field. It had been demonstrated previously that ticks experience warmer conditions in the field than they do in Stevenson screens so there should have been better hatching in the field if temperature was the most important factor. The mild spring and summer of 1970-71 provided suitable temperatures for hatching and survival of larvae from all field exposures at all sites.

Periods of continuous heavy rain during summer did not have any apparent adverse effect on successful hatching of larvae from spring/summer exposures. The wet conditions ensured that larval colonies emerging in the summer at Tabulam survived for 9 to 10 weeks. These figures contrasted markedly with the annual average of 5 to 6 weeks at Tabulam in the summer and were the same as the corresponding average of 9 weeks at Wollongbar.

Studies of Larval Survival

In studies to quantitatively assess the effect of climate on the rate of larval die-off, 10,000 incubator-raised larvae were exposed fortnightly in two series of up to 18 plots on a northerly slope. Larvae were collected from one plot per week to cover a maximum anticipated larval life of 17 weeks. Counting of the larger collections was not completed but it was clear that less than five per cent of the populations in spring remained alive after seven weeks. In summer, this period was reduced to six weeks.

Larval Productivity Studies

In a study to assess seasonal production of larvae at Wollongbar, 53 fortnightly exposures of 12 replicates of 20 engorged adult female ticks were made. Counts of the larval populations produced from the first 13 exposures, extending from June to December, 1969, were completed. They indicated that: variability in larval population was higher from exposures made in winter and early spring than from those made later in the year; the average productivity of ticks ranged from 3 to 17 per cent of potential for those exposed in winter and early spring, from 49 to 60 per cent for those exposed in late spring and early summer and exceeded 85 per cent in some replicates in summer; and close correlations existed between temperature and the mean of the log of larval populations and also between temperature and the prehatch period.

Dispersal of Cattle Tick Larvae

The development and spread of strains of cattle ticks resistant to chemicals in south-east Queensland near the state border increased the need to learn if cattle tick larvae crossed into N.S.W. Continuous sampling was achieved in fenced enclosures along the N.S.W. side of the border fence from January to May by grazing, separately, seven groups of bait cattle for successive periods of 14 days. The cattle were examined at the CSIRO Long Pocket Laboratory, Brisbane.

The examination provided unequivocal evidence of dispersal from Queensland into N.S.W. Biarra type resistance was detected in ticks collected from each group of bait cattle.

Resistance of Cattle to Ticks

Collaborative studies continued with the CSIRO Division of Animal Genetics on the development of resistance by stalled cattle subjected to different infestation regimes. A further five sets of twins were used. Analysis of the pooled results of this and the previous trial showed that the animals which received daily doses of 1,000 larvae developed resistance to ticks earlier and more strongly than those which received three dosers of 40,000 larvae at 10-week intervals.

Studies of Haemaphysalis longicornis

A study of the seasonal incidence of the three parasitic stages of the scrub tick (*Haemaphysalis longicornis*) was started in November, 1970 on a small vealer-raising property at Wollongbar. There were no discrete peaks of activity of each stage and consequently there was considerable overlapping of generations. Infestations were very heavy in summer. Activity thereafter declined, though all stages were seen on the animals through autumn and winter.

Eradication of Cattle Ticks

An eradication trial commenced in 1969-70 to determine whether ticks could be eradicated within 12 months from heavily infected pasture by dipping cattle every 21 days, was continued. Beef cattle were used — they are good dippers. Eradication was not achieved either because the programme failed or because dispersal of larvae into the paddock occurred soon after the last treatment. The second reason was unlikely, unless movement was by birds, as the area was surrounded by a five chain wide buffer in which weekly-dipped cattle were grazed.

Jersey cows, which are notoriously bad dippers, were used in a second trial which started in January. The treated animals were examined weekly. Adult ticks, that would drop the next day, were last seen on them in early June, though collections from stalled bait cattle showed that larvae were still present on the pasture at the end of June.

Acaricide Residues

Residue levels caused by three dippings in delnav at four day intervals were studied in a trial in conjunction with the Board of Tick Control Laboratory. This is the most severe treatment cattle are likely to receive under field conditions. The highest residue levels of about 4.0 ppm were reached on the third and fourth days after final dipping. After 32 days, residues in excess of 0.5 ppm were still present. Biopsy and carcass sampling of subcutaneous fat produced very similar results. Similar residue levels were found in subcutaneous and perirenal fat.

Resistance Testing

A laboratory for testing larvae for resistance to acaricides began operating in July, 1970. In preliminary work the Wollongbar reference susceptible strain was tested against all acaricides used in the laboratory to establish whether it was similar to the Yeerongpilly strain used by the CSIRO, Brisbane. The Wollongbar strain was, if anything, slightly more susceptible to most chemicals. Exhaustive testing did not find any evidence of resistance to acaricides in the field populations at the Research Station.

The Board of Tick Control submitted 75 ticks from infected properties in the Tick Quarantine Areas for testing. Of these, 44 were tested, 10 were inadequate and the remainder were awaiting test at the end of the report year. It was shown that 14 properties had Biarra type resistance, 6 had Ridglands type resistance, one had both Biarra and Ridglands type resistance and two had no sign of resistance. Samples submitted from five properties were inadequate for testing.

Both types of resistance were widely distributed throughout the Tick Quarantine Area, but a large number of the properties with resistant ticks were in the Kyogle area. Biarra resistance was found only three miles north of Wollongbar. This was disturbing in relation to possible spread to the Cattle Tick Research Station.

Acaricide Trials

A spray trial to determine efficiency and degradation of chlorphenamidine in acid and alkaline solution demonstrated 99 per cent efficiency at 0.1 per cent and 88 per cent at 0.01 per cent. Chlorphenamidine is inherently unstable in alkaline solution. Although the stability was markedly improved by reducing the pH to below 5.5 with 1.5 per cent superphosphate, the level of stability was not as great as that achieved by other workers or by ourselves in later trials. The chemical affected the ticks very quickly. The mature engorged adult and the nymph were the most resistant stages. Cattle treated with the 0.1 per cent concentration showed mild toxic symptoms consisting of sleepiness which disappeared after four hours.

A solution containing 0.25 per cent dursban and 0.01 per cent chlorphenamidine and kept at a pH between 5.0 and 5.5 by the addition of superphosphate was studied. In three months, 2,000 cattle were dipped and the chlorphenamidine proved very stable; it did not degrade or strip badly. The efficiency of the mixture was excellent and the additional cost of chlorphenamidine was 0.5 cents per beast.

An acidified combination of ethion and chlorphenamidine dip was compared with ethion. Both solutions had similar efficiency of more than 99.5 per cent. The acidified ethion-chlorphenamidine mixture also produced a reasonable level of efficiency (96 per cent) after the mixture had been allowed to settle for 15 hours. The prime effect of the settling was that the ethion concentration dropped by 20 per cent. During the three months of study, stability of the chlorphenamidine was satisfactory. In this study, triple superphosphate was used instead of superphosphate, because it had roughly twice the buffering power of the latter. In the course of dipping 1,000 head of cattle in the three months, it was necessary to add a further 50 kg of triple superphosphate to maintain the pH at a satisfactory level.

Toxicity symptoms were produced in two one-week old calves which were sprayed with chlorphenamidine at a concentration of 0.03 per cent.

The acaricidal efficiency of a new solvent free formulation of delnav was compared with the original formulation containing a miscible oil as solvent. Both formulations were equally effective in giving an almost complete kill of ticks.

Efficiency trials were conducted for three candidate acaricides: Bayer 6896 — inexplicably disappointing results; famphur — very little action against ticks; and prolate — 90 per cent efficiency where applied along the length of the spine to field animals, lower in other treatments. Results with prolate suggested that it might not act systematically.

Tests for biological efficiency were made on 70 samples taken from the dips on the New South Wales-Queensland border. Results indicated that some dips were more efficient than others. Samples from three of the dips were also tested by application to tick infested cattle. They were found to be very efficient.

Tick Resistance to Acaricides

The natively soluble cholinesterase extracted from homogenates by ultracentrifugation was concentrated to enable electrophoretic comparisons of the isozymes present in two resistant and one susceptible strain of *B. microphus*. The patterns were similar for the three strains tested indicating the lack of any new cholinesterase isozyme in the resistant strains. This point was of critical importance as it was the first evidence that the resistance of the target enzyme did not result from any new cholinesterase but probably from an increased titre of an isozyme already present in the susceptible strains.

Column chromatography of this soluble enzyme gave high recovery of cholinesterase coupled with separation of four fractions of enzymes activity. Replication of this column technique with the susceptible strain showed that each of these fractions represented a constant percentage of the total activity and that the profile of separation was consistent for each replication. However, when this technique was applied to the Biarra resistant strain it was found enzyme activity had shifted from

fractions three and four, the most prominent in the Yeerongpilly strain, to fractions one and two in the Biarra. Again no qualitative difference could be shown between the resistant and susceptible strains with this column technique verifying the electrophoretic result that no new isozyme was present in the resistant strain.

Sufficient quantities of these four fractions from each strain were produced to assess their susceptibility to common acaricide inhibitors with a view to developing specific acaricides for the resistant strains. Work on the evaluation of organophosphate and carbamate inhibitors against these fractions from resistant and susceptible strains was begun. Fractions one and two were found to be free of any large amount of contaminating protein. However, further purification was found necessary for fractions three and four.

Solubilization of the cholinesterase bound to mitochondria and microsome fractions was achieved by incubating these preparations with pancreatic lipase and recentrifuging the residues.

Sheep Blowfly Cholinesterase

This enzyme was extracted from susceptible *Lucilia cuprina* using the methods developed for cattle ticks. It was found that a much higher percentage of the total enzyme activity is soluble in blowflies than in cattle ticks. Electrophoresis of this enzyme has shown that multiple foci of acetyl cholinesterase exist in this species, as in ticks.

Introduction of Queensland Cattle into the Tick Quarantine Areas

Complement fixation (CF) and transmission tests were applied to 9 groups of cattle totalling 60 head all originally from Queensland before introduction into the Tick Quarantine Areas. All of one group of 13, while CF negative, were found by transmission test to be infected. Twelve were carriers of *Anaplasma marginale* and one was a carrier of *Babesia bigemina*. These animals had been in N.S.W. for the three years before testing. In another group of 26 animals from Toowoomba, one was found on transmission to be carrying *Babesia argentina*. It too, was negative to the CF test.

BOARD OF TICK CONTROL – CATTLE TICK RESEARCH

Chlorphenamidine

Early in the year, chlorphenamidine was added to four dips, two containing dursban, one delnav and one ethion, to check on its stability under field conditions. The depletion rate of chlorphenamidine (50 per cent w/v) was generally about 4 pints in one week in an unbuffered dip containing 2,500 gallons of solution. To control this depletion it was necessary to reduce the pH of the dip. At a pH of 6.0 to 6.5, chlorphenamidine had a half-life in the dip of about 18 days. Triple superphosphate was used to reduce pH.

Studies were commenced of the effect of buffering the dips on settling rate of the organic-phosphates and on wettability. Because of the increasing incidence of resistant ticks, 19 additional dips were charged with chlorphenamidine, so that it could be further observed in heavily used dips.

Acaricide Residues in Animal Products

Screening of meat, fat and butter samples collected from abattoirs and butter factories was continued. Meat residues of samples from Byron Bay and Casino abattoirs ranged from 0.03 to 2.02 ppm for delnav and from 0.09 to 1.97 ppm for ethion. Fat samples from Grafton Abattoir showed means of 0.05 to 0.08 ppm for delnav and from 0.05 to 0.06 ppm for ethion.

Analyses were also carried out for chlorinated hydro-carbons. In the meat fat samples from the various abattoirs, the means for dieldrin ranged from 0.01 to 0.06 ppm, DDE from 0.01 to 0.10 ppm and DDT from 0.01 to 0.43 ppm. DDT was found in only an occasional sample but the finding of dieldrin in up to 100 per cent of samples was the cause of some concern. In butter samples, the means for dieldrin ranged from 0.01 to 0.04 ppm, for DDE from 0.01 to 0.03 ppm and for DDT from 0.01 to 0.02 ppm.

LIVESTOCK PRODUCTION – FIELD ACTIVITIES

SHEEP AND WOOL SECTION

Staff

The establishment of the Section at June 30, 1971 was 52, including 3 officers seconded to research stations as Manager, or Assistant Manager. One officer was on study leave.

Three positions were reclassified to Special Livestock Officer (Prime Lamb Production), Special Livestock Officer (Fine Wool Production) and Special Livestock Officer (Sheep Management and Pasture Utilization) with headquarters at Orange, Goulburn and Tamworth respectively. The Australian Wool Board financially supported the appointment of an economist to conduct extension in the economics of sheep management. The officer is a member of the Division of Marketing and Economics but works solely with district livestock officers on sheep industry problems.

Extension Services

Change in demand. — The fall in wool prices reduced demands for ad hoc technical and managerial advice. Instead there was a call for detailed and planned economic advice relating to the diversification of production. There was also an increased demand for field demonstrations based on economic considerations. Farm Record Analysis Groups received more than normal attention. While the attitude of sheep owners did not change radically, a positive trend to more efficient use of resources was noticeable.

Flood relief. — Flood relief in the area of the Darling and its catchment occupied up to two months of the Moree officer's time and lesser periods for the Western Region and Western Division staff. The Moree officer flew 175 sorties, dropped 1,407 tons of hay to 112,000 sheep and 12,500 cattle on 172 properties.

Demonstrations. — Demonstrations conducted (with numbers for 1969–70 in brackets) were: improving reproduction — 49 (62); efficiency in pasture use — 154 (23); scientific methods in sheep selection — 37 (18); improved husbandry — 76 (42); and fleece measurement samples — 4,905 (5,517). Requests for fibre diameter measurement as part of fleece measurement were made for 96 per cent of samples compared to only 2 per cent as recently as 1967.

Topics of demonstrations and investigations were: Increased reproductive rates — fertility investigations with the Sheep Fertility Service, sheltered drift lambing, losses in reproduction, effect of selenium on lambing percentages, testing of ram percentages — one and three per cent, testing of ram percentages using teasers, testing of ram percentages — one and two per cent with teasers and effect of ram infertility. Efficiency in carrying capacity and pasture utilization — Farm Record Analysis groups, grazing lucerne as a main feed source, rotational grazing of lucerne in sheep management, summer fodder crops as a supplement, utilization of love grass (*Eragrostis chloromelas*), cereal supplements grazing comparison, Merino ewe grazing comparisons, and economic evaluation of grazing lucerne. Use of scientific methods in sheep selection — selective breeding of Merinos on production characteristics, comparison of South Australian and Peppin Merinos, comparison of Peppin strains, Goolgumbra and Haddon Rig. development of fertility flock, lifetime performance of twin and single born lambs, meat breeds performance recording, shoulder strip for production evaluation, Dormer and Border Leicester comparison, effect of body wrinkle on production, effect of bodyweight at eight to nine months on mating and lambing and growth rate and wool production of Fonthills. Improved husbandry standards and techniques — comparison of mules operation at marking, measure the extent of tail in lambs, tooth clipping trials, growth rates in stud sheep, value of sawdust in diets, wool production and bodyweight using formalin treated wheat as a supplement, effect of time of shearing on production and fertility, value of plastic coats in vegetable fault control, measuring seasonal wool growth, mineral supplement trials, survey of Western Division resources, evaluation of goat production and ill thrift in spring drop carry-over lambs.

Channels of communication. — Livestock Officers (Sheep and Wool) were responsible for 300 press items, 312 radio broadcasts, 32 telecasts, 125 field days, 168 addresses to meetings, 226 project demonstrations and 2,718 farm visits. The number of farm visits was considerably less than the 3,249 visits in 1969–70.

Extension programme planning. — The methods of reporting and recording programmes were improved. However, in most cases, planned extension was not adequately integrated into the full work programme. Some form of group in-service training seems necessary to overcome this difficulty.

Programmes aimed at promoting improved reproductive performance, efficiency in pasture use, scientific methods in sheep selection and better husbandry methods were generally continued without alteration. The fall in returns from sheep together with floods and droughts necessitated revision of other programmes to place greater emphasis on the efficient use of resources to provide for lower cost inputs.

In-Service Training

A symposium was conducted to familiarise district officers with the situation in the wool industry. Speakers were drawn from Monash University, the Bureau of Agricultural Economics, the Rural Reconstruction Board and the Sydney Wool Selling Brokers' Association.

The annual seminar for officers of the section and those engaged in sheep research was on the theme "supplements in sheep nutrition". Officers from CSIRO and this Department were seminar leaders.

The second annual course in sheep handling and selection was valuable. The venue for Merinos was at Trangie and for British breeds at Cowra, with three graziers making their properties available for the final session. Eight officers attended.

Attendances at other training courses were: Extension Methods School — four officers; Farm Management Course — four officers; Commonwealth Sheep and Wool Extension Officers' Refresher Course — four officers; and Australian Society of Animal Production Conference — six officers. Two officers were awarded the Diploma in Rural Extension. A third officer commenced the 1971 course in Rural Extension at Hawkesbury Agricultural College.

Sydney Sheep Show

For the second year at the Sydney Sheep Show, production records were made available to buyers with the consent of vendors and as a co-operative effort with the University of New South Wales. There was some but not complete relationship between sale prices and production records. Fifteen officers were on duty at the show.

Production Trends

The very marked drop in wool prices and the consequent low prices for surplus sheep, particularly in the latter half of the year, created soul searching for alternative enterprises to maintain profitability of farms. It became apparent that many accepted practices were luxuries which could not be continued. The most apparent trend was an increase in beef cattle and pig numbers. However, despite this, sheep numbers fell only slightly.

A sell out by stud breeders of Border Leicester rams, and to a lesser extent of Dorset Horn and Poll Dorset rams, took place. An exceptionally high proportion of Merinos were joined to British Breeds for first cross lamb production even in large flocks that had been pure Merino for decades. A major disposal problem for lamb is looming in the 1971-72 lamb season. Purchases of Merino rams from studs fell by as much as 50 per cent. Many commercial flock breeders retained Merino rams bred from their own flocks, rather than buy from studs. However, an increase in the amount of finer wool is still expected from the progeny of the very high 1969-70 joinings of fine Merinos when there was high demand for these rams.

There was a marked increase in the adoption of the Mules operation, including mulesing at marking time. The use of contractors continued but there was a very obvious increase in treatment by owners. Two factors considered contributory were the fly waves during the year and the low efficiency of organophosphates with no new insecticide in sight. Fly has become an even more serious problem with the lower returns for wool and sheep. While the Mules operation has shown its value in minimizing breech strike, body strike remains a severe problem in seasons favourable for fly.

The low profitability of sheep adversely affected the engagement of veterinarians, use of fertilizers and property maintenance. In many cases it was found more economical to allow sheep to die than to incur a costly input. There was less support for autumn shearing this year, although it has been increasing during the past five years and has been associated with an increase in autumn joinings. Autumn shearing was reduced particularly in areas where fleece contamination with burrs and other plant seeds is normally high. By late spring, when burr and seed shedding is at a peak, autumn shorn sheep have longer fleeces than sheep shorn in winter or spring so there can be more vegetable fault in autumn shorn clips. The present heavy penalty for vegetable fault forced a loss of support for autumn shearing.

There was a steep rise in requests for fibre diameter determinations by the Fleece Measurement Service. Some presale testing of clips occurred and certificates were displayed on sale parcels. Studs and the more progressive commercial breeders showed a much more positive interest in production performance of Merino rams. Lucerne continued to show its superiority as a pasture species. There was considerable interest in demonstrations or trials related to lucerne management.

Soiled sheep reaching abattoirs continued to cause concern but soiling was often caused after the sheep had left the producer. Land sales were few with a tendency to be at a figure well below that initially placed on the property.

Competitions

Merino ewe competition. — A total of 75 entries were received for the "Country Life" Merino Ewe Competition. Zone judgments were undertaken by district officers. The state final judgments were used for extension, with groups having a personal involvement in the theme "softness makes cents".

Carcass competition. — The demand for carcass competitions was not as keen as the previous year.

Donations

Five Angora goats were donated and the free use of a sire was made available by the Mohair Association. Some investigational work is to be undertaken to determine if a place exists in the Western Division for mohair production. A stud Fonthill ram was donated for use in a project comparing sheep meat breed in which the dams have finer wool.

Liaison with other Departments

The Principal Livestock Officer (Sheep and Wool) was a technical advisor in the proposed establishment of a Colombo Plan sheep demonstration, training and research unit in South Korea. He made a three weeks visit to South Korea and recommended a suitable site. The site was subsequently approved and preparatory work commenced.

The sheep section was responsible for overseeing the acquisition of 1,000 Corriedale ewes and 30 Corriedale rams for the Indo-Australian project at Hissar. The sheep were flown to New Delhi in special pallets. This was the biggest air lift of sheep ever undertaken. The sheep arrived in perfect condition.

Information on trends in wool and lamb was provided for the Bureau of Agricultural Economics and the State Lamb Committee. Assistance was given to the Department of Corrective Services, Maritime Services Board and the Lands Department and, on Colombo Plan projects, to the Department of Foreign Affairs. Close liaison was maintained with CSIRO, the Australian Wool Board and the Australian Meat Board.

Sheep on the Department's Institutions

There were approximately 28,000 sheep at the Department's Research Stations and Agricultural Colleges. Most were used for research. Transfers, purchases and sales amounted to about \$60,000.

BEEF CATTLE AND HORSES SECTION

Staff

Professional staff at June 30, 1971, were: one Principal Livestock Officer, one Assistant Principal Livestock Officer, twelve District Livestock Officers and thirteen Livestock Officers-in-training. A new district position was created and filled. One officer transferred to another section of the Department while three new appointments were made.

Extension Services

Extension methods. — The extension methods used by Livestock Officers (Beef Cattle) in 1970-71 (with 1969-70 figures in brackets) were: farm visits — 1,578 (1,160); field days — 170 (80); meetings and conferences — 101 (77); beef cattle schools — 40 (33); broadcasts — 273 (140); press items — 141 (80); telecasts — 16 (9); publications — 6 (4); and trials and demonstrations — 141 (43).

In keeping with greatly increased development of beef cattle production during the year, there was an increase in all extension activities. Trials and demonstrations were conducted on a wide range of management practices, including winter feeding supplements, crop grazing, feedlot practices, heifer management, modified performance testing systems, regulation of seasonal weight changes and the provision of non-protein nitrogen supplements. Under the Commonwealth Extension Services Grant, 28 beef cattle improvement demonstrations were continued, 11 were commenced and one was discontinued.

A number of schools featuring various management practices were held. They were successful but there were problems in organization and in the servicing of enquiries generated. One school on feedlots was attended by 300 people — the maximum that could be accepted. There were many unsuccessful applicants. The number of small group and farm walk field days increased in several areas.

Livestock officers organized and conducted groups of cattle owners in several study tours visiting beef cattle properties and research centres in N.S.W. and Queensland. Liaison between district livestock officers and other officers, including regional economists, improved the quality of extension.

In-service Training

One officer successfully completed the Hawkesbury Diploma Course in Rural Extension. Another commenced the course in 1971. Four officers completed practical training on Northern Australian cattle properties, while three new appointees commenced this form of training. Two officers made overseas study tours.

Production Trends

Statistics for 1970 and 1971 in N.S.W. were as follows:-

	1969-70	1970-71
Numbers — cattle mainly for meat (March 31)	4,809,200	5,730,500
Slaughterings — Cattle numbers	1,283,000	1,329,300*
Calf numbers	261,600	230,600*
Production — carcass weight (tons)	272,733	275,673*
Export — shipped weight (tons)	50,389	50,478*

*preliminary estimates

Cattle numbers increased by 921,300 head — a rise of approximately 20 per cent. Cattle slaughterings increased and calf slaughtering decreased — there was a slight net increase in production. The export situation remained almost static. An important factor contributing to the massive expansion of beef cattle numbers was stability of slaughter prices which did not vary by more than 2.2 cents per lb liveweight at Homebush throughout the year.

Other noteworthy trends were: increased interest in beef cattle nutrition with more supplementary and lot feeding practices being adopted; widespread use of non-protein nitrogen supplements; increased availability and use of artificial breeding; increased cattle weighing in selection and marketing of stock; questioning of traditional marketing methods and interest by producers in carcass grading and selling.

Competitions

The Beef Cattle Breeders' Competition, judged by officers of the section continued to provide useful opportunities for group extension — there were 116 entries. Several officers used the Meat Board carcass appraisal system in conjunction with carcass competitions.

The Department's Beef Cattle and Horses

Sales of stock were: 33 beef bulls for \$14,900; 47 Angus females for \$13,530; and 2 Arab colts for \$1,600.

Arab horses from Hawkesbury Agricultural College and Wagga Agricultural College were successfully exhibited at the Royal Easter Show.

PIG SECTION

Staff

The establishment was increased to 18 positions with a new position being created in the North Western Region. Two officers resigned and three were appointed. There were no vacancies at the close of the year. One officer was absent from his district to undertake a course in rural extension. The staff at June 30, 1971, was one Principal Livestock Officer (Pigs); 6 Senior Livestock Officers (Pigs); and 11 Livestock Officers (Pigs).

Extension and Regulatory Services

The extension and regulatory activities of the pig section are summarized in the following table:-

	1969-70	1970-71
press items	160	140
radio broadcasts & telecasts	201	169
field days	47	60
meetings attended	131	100
addresses to meetings	129	105
schools	9	11
demonstrations	5	8
farm visits	1,875	1,701
factory and abattoir visits	82	55
pig sales attended	105	109
college and research stations visits	60	60
shows attended	30	27
swine brand inspections	33	25
stock food inspections	56	62
carcass competitions	15	11

Demonstrations. — Commonwealth Extension Services Grant demonstrations of the effect of protein supplementation in a pig's diet were extended to four Regions. Those completed during the year involved part-replacement of meat meal with soya bean meal, whale solubles and fish meal and showed that soya bean meal gave a superior response to meat meal. However, its use required close economical scrutiny. Replacement of part of the meat meal with whale solubles or fish meal improved performance of pigs of up to 70 lb. liveweight but not of those between 70 and 165 lb. The change was economically questionable because of the high cost of whale solubles and fish meal. Another seven demonstrations were commenced in the latter part of the year.

Extension programme planning. — All officers in districts had planned programmes. Objectives included: improved accommodation for pigs, improved nutrition for pigs, improved management of pigs, the use of pure bred boars, the control of internal and external parasites, machinery in the piggery, and revision of the Department's leaflets.

The intended effect of these objectives was to lift efficiency rather than increase production. Programme planning has resulted in more attention being given to radio, television and press as extension media.

A major revision of the Department's leaflets on pig production was continued.

Schools for pig raisers. — The annual school for pig raisers was held at Hawkesbury Agricultural College. As usual, the attendance was restricted to 40. All parts of the State were represented. One-day schools were also conducted by local officers at various country centres.

Swine Compensation Act, 1928. — Assistance was given in the preparation, examination and processing of compensation claims for pigs destroyed and carcasses condemned on account of disease. The position of the Swine Compensation Fund at June 30, 1971, is reported in Appendix 1 of this report.

Swine Branding Act 1940. — Revision of the swine brand register continued. Sufficient cancellations of unused brands became available for re-issue to new applicants. The revision also detected brands being used by persons other than registered proprietors. In these cases, 680 brands were transferred to the present users, while 1,037 new brands were issued. Revision of the Swine Brand Index used by country officers was also continued. Since the revision was started, six revised letter sections have been distributed, a further two have been forwarded to the Government Printer while another six are still under revision.

In-Service Training

The training of junior officers at the Department's Agricultural Colleges continued and was supplemented by periods of three months in various Regions. Junior officers also attended the School for Pig Raisers at Hawkesbury Agricultural College. Other officers attended Farm Management and Extension Methods Schools.

The annual conference of pig production officers was held at Wollongbar Agricultural Research Station. All officers engaged in pig extension or research attended.

Production Trends

The pig industry in N.S.W. expanded further. On preliminary estimates the State's brood herd increased by 14,000 sows to 118,000. Production, indicated by slaughterings, also reached a record level. It is estimated that about 1,100,000 pigs were slaughtered — an increase of about 50,000.

Generally, the top prices for pigs were satisfactory, but because of the large number of pigs available each week, buyers could be selective and the price range widened. Very low prices were offered for the lower quality pigs. Saleyards continued to lose their popularity where other selling methods were available.

The consumption of pork as fresh meat continued to increase. Bacon and ham consumption also rose but only in proportion to the increase in population. The Australian per capita consumption of pork reached 17.4 lb but consumption of bacon and ham remained at the relatively low figure of 7.7 lb. No significant export trade has developed because of the high price structure of the Australian pig industry.

Assistance to other Departments and Organizations

Technical advice was given in the management of pig herds maintained at institutions controlled by the Departments of Corrective Services, Health, Education and Child Welfare. The institutions were supplied with brood stock as required. The Department of Technical Education was provided with a part-time teacher in the correspondence course in pig raising.

The services of livestock officers were called on by farmers' organizations, the Rural Youth Movement, the Australian Pig Society, the Royal Agricultural Society of N.S.W., numerous country show societies and the Rural and Commonwealth Development Banks. The Childrens' Medical Foundation and the University of Sydney were supplied with pigs for organ transplants.

The Department's Herds

The Large White, Landrace, Berkshire and Tamworth breeds were maintained at Hawkesbury Agricultural College for instruction and ration purposes. The Wollongbar (Large White) and Grafton (Large White and Berkshire) herds were used for research — nutritional and dissection studies. The piggery at Wagga Agricultural College was closed.

New bloodlines were introduced to the Hawkesbury herd. A total of 1,219 pigs were disposed of: 28 stud pigs were sold; 672 market pigs were sold; 193 pigs were killed for rations; and 326 pigs were used for research. The approximate value of these pigs was \$24,401.

POULTRY SECTION

Staff

The establishment of the Section consisted of a Principal Livestock Officer (Poultry), one Assistant Principal Livestock Officer, and ten Livestock Officers. There was one resignation, one new appointment and one vacancy remained unfilled. Three new positions, Poultry Inspectors, were created under the Poultry Processing Act, and appointments were made.

Two Livestock Officers (Poultry) positions, previously located at Parramatta and one poultry extension position in the Southern Region were transferred to Seven Hills Poultry Research Station. The changes resulted in greater centralization of activities in the Sydney area, an improvement in office accommodation and a closer liaison between extension and research.

Extension Services

Objectives of extension programmes. — Main objectives of extension officers' programmes were: to encourage increased use of labour saving mechanical devices; to encourage the use of egg cool rooms to maintain egg quality; to investigate factors affecting egg quality on commercial farms; to develop a farm management study to improve efficiency for both replacement pullet and commercial egg production; to reduce the early mortality of chickens, with particular emphasis on brooding equipment and methods employed; and to orient Random Sample Layer Tests with industry practices.

Short-term objectives towards these long-term objectives were achieved. Programme planning has changed the emphasis in extension activities, leading to greater specialization, closer involvement with integrated groups of producer and more efficient development of the industry.

Programme planning has also increased the number of field trials of practices such as forced moulting and its effect on egg quality, restricted feeding of replacement pullets to control the rate of sexual maturity and the improvement of the environment during brooding. This last project was supported by funds from the Chicken Meat Research Foundation. Treatments compared the effectiveness of hot air and radiant heat brooders, the techniques of brooding and their effect on profitability.



Packing eggs as they were collected reduced soiling at the Poultry Research Station, Seven Hills. New methods and increased efficiency could not completely compensate for low returns for eggs in 1970-71. Returns below the cost of production for many egg farmers and a large surplus of egg pulp lead N.S.W. to advocate a stabilization scheme for the industry.

Farm management studies. — Farm management studies were developed — five farms were in a replacement pullet study and ten in an egg production study. The transfer of extension officers to Seven Hills Poultry Research Station assisted in the re-organization of the studies to allow computer analysis, which is expected to improve their value.

Annual field day. — The annual poultry field day at Hawkesbury Agricultural College was attended by over 1,000 people and was supported by all major commercial poultry organizations. The field day has become the most comprehensive poultry field day in the Commonwealth.

Poultry seminar. — The poultry farmers' schools, previously conducted at Hawkesbury Agricultural College, were replaced in 1971 by a three-day seminar at Parramatta on the theme "economics of change". Over 250 people registered for the seminar which was organized with a poultry industry committee.

"Poultry Notes". — This quarterly publication was maintained with contributions from an increased proportion of the extension and research staff. "Poultry Notes" was aimed at providing new and relevant information and advice to the commercial industry. Its articles were frequently reproduced in the local and interstate farming press.

Summary of extension activities. — The following is a summary of the extension activities of livestock officers (poultry) in 1970-71 with 1969-70 figures in brackets: press items — 73 (52); radio broadcasts — 141 (117); field day sessions — 10 (11); addresses to meetings — 102 (126); demonstrations — 11 (8); and farm visits — 1,356 (1,517).

Emphasis changed to make greater use of mass media and reduce the number of farm visits. The trend was towards more specialized extension, more project demonstrations and increased involvement with integrated poultry organizations.

Random Sample Tests

The industry continued to support random Sample tests; 15 participants were included in the 18th layer test which concluded during the year and 16 in the 19th which had not been completed. In the 19th test there were four entries from the Seven Hills Poultry Research Station and three non-competitive entries by nucleus breeders. These tests provide information to commercial breeders and assist egg producers to assess the relative merits of breeding stock.

At the invitation of the Department of Agriculture, all large scale commercial meat chicken breeders, responsible for 95 per cent of the meat chickens hatched in Australia, participated in a Random Sample Broiler Test at Hawkesbury Agricultural College. The test was conducted in both controlled environment and conventional type houses and provided useful data on the performance of meat chickens and the relative efficiency of controlled environment and conventional housing. At the completion of the test, carcass quality and aspects of processing were measured. Average bodyweight at 67 days of age was 4.01 lb with a feed conversion ratio of 2.4 lb of feed per pound liveweight. Participants requested resumption of regular tests of this type.

In-service Training

A conference of all officers engaged in poultry extension and research, held at Seven Hills Poultry Research Station, resulted in closer collaboration between extension and research teams. Discussion also led to a clearer understanding of the situation of the local industry, the overseas scene and the purpose and direction of future poultry extension activities.

Officers attended a conference organized by the Australian Chicken Meat Federation, a Poultry Production Review Conference organized by CSIRO and a Poultry Information Exchange organized by the Queensland Department of Primary Industries. In addition, all officers visited Seven Hills Poultry Research Station and attended the Annual Poultry Field Day. There was increased communication between district officers.

Legislation

The Poultry Processing Act 1969 came into force in May, 1971. Its main purpose is to control the uptake of water by poultry carcasses in processing plants and to provide uniformity in the contents of giblet packs and the labelling of carcasses to indicate the inclusion or otherwise of giblets.

The Poultry Advisory Board sub-committee on egg production presented a report to the Minister for Agriculture with recommendations for stabilization of commercial egg production. The proposal required uniform acceptance by all eastern states. A final decision is awaited.

International Training Course

Poultry officers organized and participated in an International Training Course in Poultry Husbandry conducted by the Department of Foreign Affairs. The N.S.W. segment of the course, which was of six weeks duration and covered major aspects of husbandry, disease control and marketing, was attended by 23 members from 16 Afro-asian and Colombo Plan countries.

Pesticide Residues

Officers again investigated pesticide residues revealed by Egg Marketing Board Surveys. The general trend has been towards a reduction in the extent of this problem.

Production Trends

Eggs. — Over-production of eggs continued. Receipts at the N.S.W. Egg Marketing Board were 69.9 million dozen — 10.6 per cent more than in the previous year. Sales by the Board increased by 3.7 per cent. Producer agency sales amounted to 18.1 million dozen, 6.1 per cent more than 1969–70. The export situation remained unsatisfactory and a large carry over of surplus egg pulp is anticipated.

The Central Egg Marketing Authority (CEMA) Hen Levy was maintained at its maximum level of \$1 per bird per year but was insufficient to equalize export prices at a satisfactory level. A pool of 1 to 1.5 cents per dozen was levied to supplement CEMA reimbursements. The number of layer strain pullets hatched in N.S.W. was approximately 11 per cent less than 1969–70 indicating the possibility of decreased production next year. However, hatching figures in other States increased.

The average return to producers, after payment of the hen levy was 27.6 cents per dozen, 6 cents below the return in 1969-70. This is less than the production cost for many producers. Negotiations on stabilization proposals encouraged some producers to maintain larger flocks than normal. Smaller producers continued to leave the industry; there was a noticeable rise in the number of farms with more than 15,000 layers. The following table shows the numbers of farms in size categories in May, 1970 and 1971.

Flock size and farm numbers

Size of farm	May 1970	May 1971	increase/decrease
Under 75	541	464	77
76 - 150	303	281	22
151 - 500	412	373	39
501 - 1,000	234	208	26
1,001 - 2,000	269	233	36
2,001 - 3,000	201	184	17
3,001 - 5,000	246	220	26
5,001 - 7,000	118	128	+ 10
7,001 - 10,000	105	103	2
10,001 - 15,000	49	45	4
15,001 - 20,000	21	31	+ 10
20,001 - 30,000	16	23	+ 7
30,001 and over	4	7	+ 3
Totals	2,519	2,300	() 219

The price of cull hens remained depressed at 8 to 11 cents per lb. More producers compounded rations for their birds instead of purchasing commercially formulated feed. The number of requests for information on this subject increased.

Meat. — Meat chicken production expanded at a higher rate than in the previous year and slightly exceeded the increase in consumption. Stocks held by processors increased and some organizations commenced voluntarily reducing output. Retail convenience outlets for poultry continued to develop but apparently have not affected the sale of frozen carcasses. Interest was shown in hot air brooding and controlled environment housing and a number of integrators incorporated these methods in new facilities.

Turkey production expanded at a faster rate than demand. Heavy price competition occurred between major integrators and seriously affected smaller turkey processors. Duck production also expanded at a higher rate and intensified as integrated organizations and one large individual producer develop specialized breeding and production facilities.

Poultry Slaughtered in N.S.W.

Trends in the number of poultry slaughtered in N.S.W. are shown in the table below.

Year	Chickens	Ducks	Turkeys
1967/68	36,556,000	335,000	483,000
1968/69	34,838,000	535,000	683,000
1969/70	38,848,000	538,000	982,000
1970/71	49,196,000*	722,000*	1,127,000+

*Provisional figures + Bureau of Census and Statistics

APICULTURE SECTION

Staff

The establishment of the Section consisted of one Principal Livestock Officer (Apiculture) and seven Livestock Officers (Apiculture). There were no vacancies at the end of the year. One officer was absent during 1970 at a diploma course in rural extension.

Extension Services

Summary of extension activities. — Officers of the apiculture section were responsible for: 54 press items; 62 radio broadcasts; 1 telecast; 3 field day sessions; 27 addresses to meetings; and 667 farm visits.

Group extension. — The main group extension effort was directed towards the Commercial Apiarist's Association (CAA) of N.S.W., branches of which exist in the three inland agricultural districts. Officers in these districts attended meetings, dinners and committee meetings of the CAA and were involved in group development and educational campaigns with the branches. Many hobbyist beekeepers were encountered through the Amateur Beekeepers' Association.

Press. — The industry journal, "The Australasian Beekeeper", was the main outlet for technical articles, policy statements, advice and beekeeping news and views. A second industry publication used was the monthly "C.A.A. News", a newsletter published by the Commercial Apiarist's Association and mailed to all association members. Metropolitan and local newspapers were also used.

Programme planning. — Extension plans submitted by officers included the following objectives: create awareness of the threat to apiculture of indiscriminate use of pesticides and weedicides; develop ability of producers to collectively apply a basic decision making process to their common problems; demonstrate the value of bees as pollinators of certain crops; encourage careful handling of honey in the extraction process; familiarize beekeepers with the symptoms of American brood disease; and encourage branding of beekeeping material with apiary registration numbers.

Pollination. — There was a dramatic increase in the acreage of rape seed produced in N.S.W. The pollination requirements of rape vary according to variety. Initial experience indicated that insect pollination was of economic benefit to growers.

Protection from pesticides. — Control of insect pests of sunflower, safflower, corn, sorghum, cotton, rape and lucerne has meant use of materials toxic to bees. Protection of the states' population of insect pollinators in a rapidly changing agricultural environment was the subject of much discussion at beekeepers' meeting throughout the year. The Commercial Apiarists Association of N.S.W. appealed to this Department for help. That apiary officers were equally concerned was evidenced by the emphasis given in their extension programmes to protecting bees from pesticides. Central western beekeepers sought aid regarding bee losses caused by pest control on rape crops. Officers of the Division of Plant Industry and the Biological and Chemical Research Institute co-operated with the section in on-the-spot investigations and in planning future research programmes.

Preliminary assessments were made, with CSIRO and the Waite Agriculture Institute, of a range of syrups to determine their suitability for feeding bees.

Annual school. — The usual annual school in apiculture was held at Hawkesbury Agricultural College; the attendance was 20.

Research Extension Liaison

The Principal Livestock Officer (Apiculture) represented the Standing Committee of the Australian Agricultural Council on the Honey Research Advisory Committee. The Committee's main function is to allocate research funds provided by the Australian Honey Board and a subsequent Commonwealth grant. Apiary officers collected honey samples for the CSIRO.

Bee Diseases

American Foul Brood (Bacillus larvae).— The number of outbreaks continued to decline — 114 infected hives were found in 17 apiaries.

Nosema (Nosema apis) caused losses in many apiaries and the Department commenced to equip officers with field microscopes to assist diagnoses.

Production Trends

Honey production was below average in most districts. Exceptionally mild and dry weather during winter and early spring adversely affected colony development so that many beekeepers experienced difficulties in building up hive numbers. Coinciding with the flowering of the major honey producing species on the coast and in the south, prolonged wet and overcast conditions affected the blossoms and nectar secretion as well as bee activity.

On the central and north coast production was below expectations. In the north-west, the season commenced well, but overall production was generally down. In the south-west, honey production was extremely low prior to autumn. Probably the heaviest concentration of bee hives ever migrated to a particular area in this state took place on the south coast. Hives from as far as South Australia were moved to the spotted gum areas of that region.

Because of an almost unprecedented demand for most grades of honey, carry-over stocks from previous seasons were used, leaving the supply of better grades at an all time low. Prices to the producer advanced at least to the stage where they kept pace with the steep rise in production costs during the year. The increased prices were largely due to the generally poor season in most of N.S.W. and in some of the other Australian honey producing states. A further factor was that poor crops in other major exporting countries caused a strong world demand for Australian honey. As a result, export prices were the best ever. However, this situation is not likely to continue when normal exports from Argentina and Mexico are resumed.

The Department's Apiaries

Approximately 1,000 queen bees were produced at the Department's main apiary at Hawkesbury Agricultural College and made available to honey producers in this state and throughout the Commonwealth. Both artificially inseminated selected stock and naturally mated strains were produced.

The apiaries from Wagga Agricultural College and Tamworth Agricultural Research Station were transferred to Hawkesbury Agricultural College.

LIVESTOCK PRODUCTION RESEARCH

SHEEP RESEARCH – TRANGIE AGRICULTURAL RESEARCH STATION

The Influence of Selection on Fertility

Selection for fertility is actively practised in only two flocks at Trangie, the fertility flock and the selection demonstration flock. In the former, ewes which do not rear a lamb to weaning are culled and only twin born rams are used. In the selection demonstration flock, ewes which fail to rear a lamb to marking are culled while there is also selection for wool quantity and quality.

In the light of information available on the inheritance of reproductive performance in Merino sheep, selection for reproductive performance in this way is likely to improve lifetime performance without greatly influencing the genetic merit of the flock.

The phenotypic superiority of these two flocks has been demonstrated with each year's lambing. The superiority was again evident in the results of the 1970 lambing. The fertility flock which is joined for 5 weeks in February–March to 2 per cent rams, weaned 123 lambs per 100 ewes joined. The equivalent mean figure for other flocks joined in February was 93. Similarly, the selection demonstration flock, with similar management except joining which begins in early April, weaned 108 lambs per 100 ewes joined, compared with 79 lambs per 100 ewes in other flocks joined in April.

All components of reproductive performance contribute to the increased fertility of ewes in the two selected flocks. There were relatively fewer dry ewes, a greater proportion of multiple births and no greater lamb mortality.

A Comparison of Lambing Management Systems

This experiment was initially designed to compare lamb mortality under supervised and unsupervised lambing management systems. Between 1964 and 1966, the supervised system which involved "drifting" into adjacent small paddocks, resulted in a considerable reduction in the lamb mortality. From 1967 to 1969 the flock was split into three according to the expected date of lambing. Each sub-flock was then left to lamb in a separate paddock. The results from these three years indicated no differences between the drift and the modified unsupervised system. Lamb losses between birth and weaning varied between 11 and 19 per cent.

Results from the 1970 lambing indicated that these results were not due to the low level of dystokia in the experimental flocks. The use of a less fertile flock in the comparison, having a higher proportion of ewes giving birth to single lambs, resulted in both the supervised and unsupervised treatments having similar low levels of lamb mortality.

Association Between Blood Characteristics and Production

The aim of this project, conducted in association with the Department of Physiology of the University of New England, is to determine the relationships between the concentrations of various blood metabolites and genetically or environmentally induced differences in production.

The main results has been a highly significant association between the concentration of potassium in red blood cells and fleece weight. No further experimental work was conducted during 1970-71, but the complete statistical analyses are being undertaken by the University of New England.

Selective Breeding of Merino Sheep

Most of the single character selection flocks continued to respond to selection. However, selection for clean fleece weight (fleece plus flock) continued to show no further response in that character. In addition, the erratic response that has been observed in the face cover selection flocks continued and these flocks were abandoned because of their relatively small applied breeding value.

The commercial demonstration flock selected for wool production (nucleus flock) had clean fleece weights 32 per cent higher than the control flock. This is the largest deviation observed in any one year. The stud flock was only 20 per cent above the control flock in clean fleece weight. The commercial flock, selected for both fertility and wool production (fertility flock), was 6 per cent above the control flock in clean fleece weight. This value is lower than would be expected, but the flock still maintains such desirable characteristics as low levels of skin fold and face cover, and high bodyweight.

Effect of Selection for Weaning Weight on the Lambing Performance

The differences in fertility at six to seven months of age between ewes selected for and against weaning weight and a random control were compared in a pilot study. Preliminary results indicated that the weight plus ewes reached puberty earlier than the weight minus ewes and also got into lamb more successfully at an early joining. A larger trial will examine the weaner lambing performance of these flocks in more detail.

Genotype Influencing the Incidence of Fleece Rot

Contrary to the data presented last year, no obvious relationship between fleece rot and fold score could be found when information collected over several years was analysed. There was, however, some evidence of a relationship between fleece rot and clean fleece weight.

Selection and the Efficiency of Conversion of Feed to Wool

Two avenues of research on the influence of selection on the efficiency of conversion of feed to wool were followed in 1970-71.

In the first an experiment was designed to investigate the relationship between dietary characteristics and wool production, and various biochemical parameters associated with this relationship. It had become evident in previous work that the study of genetic differences in efficiency required more detailed information on the process of converting feed into wool.

Equipment was acquired, technicians trained and problems of measurement were solved for the experiment.

The second avenue of research centred on the sensitivity of epidermal follicle forming tissue in the foetal lamb to the amino acid nutrition of the ewe. Preliminary results indicate that although the primary follicles may be insensitive, the secondary follicles are quite responsive to improve amino acid nutrition of the pregnant ewe.

Selection and Management Practices in Relation to Carcass Characteristics

In a project to determine the contribution of genotype and rearing on carcass composition, weaning weight plus and minus ewes were mated to Dorset Horn rams. The lambs were slaughtered at birth and at intervals of 1 week, 3 weeks, 8 weeks, 16 weeks and the viscera and carcass weighed. On evidence so far from examination of growth rate and perirenal fat deposition, it appears that the weight plus lines grow more quickly and mature earlier than the weight minus lines.

SHEEP RESEARCH IN CO-OPERATION WITH THE DIVISION OF ANIMAL PHYSIOLOGY, CSIRO

Effects of Heat on Ram Fertility

Radiotelemetry techniques were used to measure the scrotal temperatures of rams grazing freely. Scrotal temperatures rarely approached 40°C and were normally around 34° to 38°C. Under these conditions it is unlikely that testicular temperatures would be high enough for long enough to cause infertility. Even if infertility did occur in some rams, they would need to be sexually dominant in order for there to be any effect on flock reproductive performance.

Post Partum Mating of Sheep

Two studies aimed at characterizing the endocrine status of ewes with and without lambs immediately after parturition were carried out in October – November and June – July. Plasma samples were obtained for analysis for hormone content. Spring parturition appeared to delay the first ovulation and oestrus, although these were advanced by removal of lambs at birth. Complete data for ewes lambing in June was not available.

Treatment with exogenous hormones to induce early breeding in lactating ewes was tested. Treatment in spring with progesterone and pregnant mare's serum gonadotrophin (PMSG) resulted in 56.6 per cent of ewes exhibiting oestrus and 74.1 per cent ovulating by day 15 after lambing. This was a lower response than that observed in similarly treated ewes lambing in the autumn (95 per cent oestrus, 100 per cent ovulating). Further hormone treatments up to day 26 after lambing resulted in an even lower response (29 per cent in oestrus, 62.3 per cent ovulating), although the hormone treatment was necessary to evoke oestrus behaviour. The recovery of eggs from ewes mated at either 15 or 26 days after lambing was low and only one fertilized ovum was recovered (mating day 26). The response to progesterone and PMSG was considerably lower in ewes lambing in the spring than in those lambing in the autumn. Fertility and matings at both times were also low. Although the ovary is able to respond to exogenous gonadotrophin, the preparation used (PMSG) appeared to upset normal egg transport and affect the normal function of corpora lutea. It may interfere with endogenous pituitary function.

Direct stimulation of pituitary gland function was examined by treating lactating ewes with oestradiol benzoate and testosterone propionate. At the correct levels, both compounds evoked a pituitary response as evidenced by an elevation in peripheral plasma concentration of luteinizing hormone.

Identification of Twin Bearing Ewes

Plasma progesterone concentrations were determined in ewes at various stages throughout pregnancy to identify twin bearing ewes. Preliminary results indicated that it is unlikely that such ewes can be identified in this way before the last third of pregnancy. Mature twin bearing ewes could be identified, though not with complete accuracy, from the plasma progesterone levels in samples taken between 100 and 140 days of gestation.

The remainder of the work planned on this project is concerned with increasing the accuracy of the twin diagnosis and examining some of the factors that may be associated with progesterone levels in pregnant sheep.

Reproductive Wastage and Fertility

Nomograms were produced to allow rapid estimation of sample sizes required to measure reproductive parameters. The sampling methods are being checked with data derived from wastage trials in New South Wales and Victoria.

Extensive data from both states were examined to verify assumptions made in the model. It appeared that when two ova are present, the probabilities of fertilization for each egg are not independent if fertilization rates are depressed. If fertilization rates are high, the probabilities of fertilization for each egg operate as if independence exists. Loss of zygotes appeared to occur independently after day 12 after mating.

Pre-mating shearing of maiden ewes resulted in less mating than in woolly maidens. Embryonic loss was higher in the woolly ewes, the net result being a similar pregnancy rate at 30 days after mating.

SHEEP RESEARCH — COWRA AGRICULTURAL RESEARCH STATION

Grazing Systems for Lamb Production

An experiment to investigate the influence of management of Crossbred breeding ewes and lambs on animal and pasture production began at Cowra in 1966. The best lamb growth rates have been obtained when the ewes and lambs were set-stocked but lambing percentages declined during the past few years. Saving areas of pasture for special periods depressed lamb growth rate and bodyweight of ewes. The original pasture comprised subterranean clover, ryegrass and lucerne. Set-stocking eliminated the lucerne and paddocks set-stocked ended up mainly as capeweed. The dominance of capeweed, which has a slow growth rate when ewes are joined, could explain the declining lambing percentages of the ewes on set-stocked treatments.

Genetic Predisposition of Sheep to Pneumonia

The incidence and magnitude of pneumonic infection in flocks of Border Leicester sheep from different genetic sources has been studied. Ram lambs from the 1969 and 1970 drops from five small flocks were slaughtered at six to eight months of age and the lungs examined. The proportion of lungs with infection ranged from 25 per cent to 73 per cent for the different flocks. The flock with the lowest level of infection comprised sheep with 25 per cent Merino "blood" whereas the flock with the highest incidence had produced lambs previously with a high level of pneumonic infection. A purchased flock that was claimed to have had a history free from pneumonia had an incidence of 42 per cent. Although the numbers are small, these results suggest that there are differences between the flocks in the incidence of the disease.

Hybrid Vigour in Lamb Production

The importance of hybrid vigour in crosses between the Border Leicester and Merino is being assessed. Results so far have shown hybrid vigour of 5 to 10 per cent for characters such as lamb growth, wool production and skeletal measurements. However, hybrid vigour for reproductive performance of the F1 ewes has been about 50 per cent.

In 1970, crossbred ewes had a considerably higher percentage of lambs born and weaned than either of the purebred ewes. As in 1969, the oldest age group of Border Leicester ewes, those of their fifth lambing, had the highest proportion of dry ewes. Many dry ewes and a low percentage of ewes with multiple births contributed to the low performance of the Merinos.

SHEEP RESEARCH — TEMORA AGRICULTURAL RESEARCH STATION

Breed Comparison Trial

The productivity of the Corriedale, Polwarth, Peppin Merino and Bungaree South Australian Merino breeds, and the Border Leicester x Peppin Merino fixed halfbred (BLM) are being compared in a trial that began in 1969.

The reproductive performance and lamb growth rates of the BLM and Corriedale flocks were higher than those of the other flocks, with the BLM being superior to the Corriedale flock. There was no difference in the weight of lamb weaned per ewe joined between the Polwarth and Peppin Merino flocks. The Bungaree flock produced the largest amount of clean wool per head. There was no difference in clean fleece weight per head between Polwarth and Peppin Merino flocks. When fibre diameter was considered, the advantage of the Merino flocks in wool production increased because of the finer fleeces of the Merinos.

The crossing performance of the breeds with the Dorset Horn is to be compared in 1971-72.

Control of Blowfly Strike by Management

The effect of the various management practices used to reduce the incidence of blowfly strike have been: mulesing at marking was extremely effective in reducing the incidence of breech strike; jetting was an uneconomic treatment in 1970 because the fly waves were over by the time the sheep were jetted but was effective in 1968 and 1969 in reducing additional body strike once a fly wave had begun; and shearing of lambs slightly reduced body strike in 1970 but had not consistently done so in previous years.

SHEEP RESEARCH — LEETON AGRICULTURAL RESEARCH STATION

The Effect of Nutrition on Fertilization and Embryo Survival

Two factorial experiments were commenced to study the effects of bodyweight and nutrition on fertilization and embryo mortality in maiden and mature Border Leicester x Merino ewes. Dorset Horn rams were joined to 336 ewes in January (experiment 1) and 388 ewes in May (experiment 2).

Fertilization rates were determined in half the ewes in experiment 1 and one third of the ewes in experiment 2. The remaining ewes were allowed to go to term following differential feeding of maintenance and sub-maintenance rations during the three weeks after oestrus.

There were no significant effects of bodyweight or age of ewe on fertilization rates. Where ewes were joined in May, half were treated with 500 I.U. pregnant mare's serum gonadotrophin (PMSG). The magnitude of the ovarian response to PMSG was independent of bodyweight and age of ewe. Results for ewes allowed to go to term were not available at the end of the year.

Cheviot x Merino Comparison

Border Leicester x Merino, Merino and Cheviot x Merino ewes, bred from a common flock of Merinos, are being compared as prime lamb mothers on irrigated pastures when mated to Dorset rams in either spring or autumn. From 1965 to 1969 the Border Leicester x Merino ewe was superior to the Cheviot x Merino in fertility and lamb and wool production. It was superior to the Merino in lamb growth, carcass quality and number of lambs dropped from an autumn joining. Wool production from Border Leicester x Merino and Merino ewes was similar. Price per kilogram of wool and the number of lambs dropped from spring joining were greater for Merinos.

Results in 1970 largely confirmed those obtained previously. Gross returns per ewe joined for Boarder Leicester x Merino, Merino and Cheviot x Merino ewes in 1970 were: Autumn joining (1970)—\$8.32, \$6.76 and \$6.81 respectively; and Spring joining (1969)—\$7.17, \$7.33 and \$6.47 respectively.

Six years' results have demonstrated that the Cheviot x Merino ewes under observation have been relatively uneconomical as prime lamb mothers because of low fertility, particularly lack of twinning, and lower wool production.

The Fertilizable Life of Ram Spermatozoa

Base information on the fertilizable life of ram spermatozoa in the reproductive tract of the ewe was obtained in a pilot study. Ewes were inseminated into the uterus at various times before and after the onset of oestrus with 200×10^6 , 20×10^6 or 2×10^6 spermatozoa. Eggs were recovered 36 hours after the onset of oestrus and examined for evidence of fertilization.

The results showed that ram spermatozoa remain fertile for at least 48–60 hours in the female reproductive tract. This is much longer than is suggested in the literature. Further work would be required to establish the upper limit to the fertile life of spermatozoa.

Rates of Penetration and Activation of the Sheep Egg by Ram Spermatozoa

Eggs were recovered from ewes 1.5, 2.5, 3.5, or 4.5 hours after insemination into the fallopian tubes of ewes after ovulation in an experiment at the McCaughey Institute, Jerilderie. Spermatozoa inseminated were either freshly ejaculated or they had resided in the female reproductive tract for at least 4 hours before insemination. The purposes of the experiment were to determine the time that elapsed before eggs were penetrated by spermatozoa and the effect of incubation of spermatozoa in the reproductive tract. At 1.5 hours after insemination the majority of eggs had been penetrated by spermatozoa.

Additional data has now been obtained to determine the time of sperm penetration. Eggs were recovered 0.5 and 1.0 hours after insemination. The earliest time of sperm penetration observed was 1.0 hours after insemination when 6 of 22 eggs had been penetrated by spermatozoa which had been incubated for 4 hours in a ligated section of the uterus prior to insemination. Sperm penetration had not occurred at 1 hour in any eggs recovered from ewes inseminated with untreated semen.

The additional results provided increased support for the suggestion that capacitation of spermatozoa is a necessary prerequisite of fertilization in the ewe.

SHEEP RESEARCH —COWRA AND GLEN INNES AGRICULTURAL RESEARCH STATIONS

Crossbreeding in Prime Lamb Production

Various combinations of the Merino, Border Leicester and Dorset Horn breeds, born and reared under the same conditions, have been tested for prime lamb production. Over a number of years there has been little difference in reproductive performance between Border Leicester x Merino and Dorset Horn x Merino ewes when joined in the autumn. Both crossbreds have been superior to Merino ewes because of a higher percentage of multiple births. From spring joinings the Dorset Horn x Merino ewes have had more lambs because of a low proportion of dry ewes. The lambing percentage of Border Leicester x Merino ewes has been variable from the spring joinings but, in

general, it has been below that of the Merino ewes. The wool production from the Dorset Horn x Merino ewes has been below that of the other two breeds, but the crimp frequency has been higher than in the Border Leicester x Merino.

SHEEP RESEARCH – SHANNON VALUE NUTRITION STATION

Poor and Improved Merino Strains under High and Moderate Stocking Rates

In this trial two breeding flocks have been established, one selected for high fleece weight (fleece plus) and the other for low fleece weight (fleece minus). The groups each of 210 breeding ewes, (half fleece plus and half fleece minus) are grazed at different stocking rates (5 and 15 breeding ewes per hectare). The aim is to discover if the genetically determined differences in wool production are fully apparent under a high stocking rate husbandry system which minimizes fleece cut per head.

At the 1970 lambing there was a significant difference between stocking rates in number of lambs weaned (high stocking rate 48 per cent, low 68 per cent). The fleece plus ewes produced 46 per cent more greasy wool than the fleece minus ewes at the low stocking rate and 44 per cent more at the high stocking rate.

Results from four years indicate that the difference in greasy wool production between the fleece plus and fleece minus flocks is reduced by only five per cent when they are grazed at high rates.

SHEEP RESEARCH – TAMWORTH AGRICULTURAL RESEARCH STATION

Dorset Horn versus Border Leicester x Merino Ram Comparison

Mature bodyweight is being used as a selection criterion for prime lamb sires. Only Dorset Horn sires were used this year – six sires with a range of mature bodyweights were separately mated to groups of approximately 40 first cross ewes. Carcass weights and bodyweights of all progeny were measured.

In 1970–71, for each 10 kg increase in the mature bodyweight of the sire there was a response of 0.7 kg in the bodyweight of offspring. This response was similar to the response of 0.9 kg obtained in previous years. While mature bodyweight of sire could be useful as a selection criterion it is expected that higher responses would be obtained by selection on bodyweights measuring during the growth period.

Forage Sorghum for Sheep

Growth of ewes and lambs grazed on the perennial, *Sorghum alnum*, and an annual sorghum-sudan grass hybrid was measured over three summer seasons. Growth rates of adult sheep grazing these crops were 73 and 75 g/head/day respectively. Weaned lambs had low growth rates, 24 and 25 g/head/day, compared to the growth rate of 159 g/head/day of lambs grazing lucerne. The poor growth could not be attributed to availability of feed. An examination of gut fill of lambs grazing the different crops together with nitrogen and *in vitro* digestibility analyses indicated that low digestibility of the forage sorghums was the main factor limiting bodyweight gains by lambs.

SHEEP RESEARCH – GRAFTON AGRICULTURAL RESEARCH STATION

Prime Lamb Production on the Lower Clarence River Alluviums

In a high rainfall area where sheep raising is not normally practised, Dorset Horn x Merino ewes (DH x M) and Merino ewes (M) are being compared as spring joined mothers of lambs grown for local meat consumption. The ewes are stocked at 15 per hectare and drenched either every four weeks or strategically. In 1970, the number of lambs born to DH x M ewes, 79 per cent, was greater than those born to M ewes, 51 per cent. The number of lambs raised for slaughter were 68 per cent and 42 per cent respectively.

The mean carcass weight was 45.5 ± 0.3 per cent of liveweight for lambs from DH x M ewes and 41.5 ± 0.2 per cent for lambs from M ewes.

Mean fleece weights in 1969 were 2.06 ± 0.03 kg/head (DH x M) and 2.48 ± 0.02 kg/head (M). The wool, including crutchings and pieces, sold for an average price of 12.9 cents/kg (DH x M) and 18.6 cents/kg (M). Mean fleece weights in 1970 were 2.60 ± 0.04 kg/head (DH x M) and 3.45 ± 0.04 kg/head (M).

In 1971, more lambs were born to DH x M ewes (65 per cent) than to M ewes (22 per cent). Drenching had no effect on lamb or wool production.

SHEEP RESEARCH - CONDOBOLIN AGRICULTURAL RESEARCH STATION

Border Leicester Improvement

The effect of first joining ewes at seven months of age on production of lambs and wool is being examined. The two ewe flocks have been obtained by successively backcrossing fixed BLM ewes to Border Leicester rams. They have 75 per cent and 88 per cent of the genes derived from the Border Leicester respectively with their remaining genes coming from the Merino. Service at seven months was related to later reproductive performance. At the 1970 spring lambing, ewes that were joined but not served at seven months of age in 1968, had a lower lambing percentage than those served at seven months. A higher proportion of the twin than the single 1969 drop ewes joined at 9 months were served and subsequently lambled. However, the survival of these lambs was only 29 per cent. Most of the losses were attributed to starvation - mismothering associated with poor pasture conditions for the ewes. Generally, ewes that had lambled at 12 months of age produced less clean wool per head and had shorter staple than ewes that did not lamb at 12 months.

SHEEP RESEARCH IN CO-OPERATION WITH DISTRICT LIVESTOCK OFFICERS

Lifetime Performance of Single- and Twin-Born Merino Ewes

Single- and twin-born Merino lambs were identified soon after birth on a number of properties. Bodyweights were recorded at marking and weaning, and prior to mating each year. Body dimensions were recorded at weaning and prior to the two-tooth mating. Fleece production and fertility were recorded each year.

Differences in fleeceweight between single and twin born ewes disappeared after 18 months of age, and differences in body dimensions at between 12 and 18 months of age.

Data on reproduction has been inconsistent - sometimes differences were negligible, sometimes they favoured the twin-born groups. Results on three properties in 1970 showed increased fertility with twin-born groups on two properties but no difference on the third.

Ram Percentage Comparisons

The effects of ram percentage and the presence of mature ewes on the mating performance of maiden ewes were investigated in six experiments in 1970 with approximately 3,200 ewes. Of the six properties, four showed little effect of ram percentage or presence of mature ewes, one showed reduced fertility at one per cent of rams, and one a confounded effect between ram percentage and the presence of mature ewes.

The results indicate that it would be unwise to recommend the use of one per cent of rams for joining with maiden ewes, particularly if they are to be joined in the same group as mature ewes.

BEEF CATTLE RESEARCH - GRAFTON AGRICULTURE RESEARCH STATION

Beef Cattle Production from Three Pasture Systems

The liveweights for Hereford cows and calves grazing three pasture associations at several stocking rates were recorded at four-weekly intervals. The three pasture associations were: native pastures; native pastures topdressed with superphosphate and oversown with a naturalized strain of white clover (*Trifolium repens*); and native pastures topdressed with superphosphate and oversown with ladino white clover (*Trifolium repens*), *Lotononis bainesii* and *Lepedeza striata*. The legumes were oversown while all plots were continuously stocked.

The mean liveweights of cows and calves grazing the two improved pasture associations were consistently greater at higher rates of stocking than those of cows and calves grazing the native pastures. Increases of 66 per cent and 95 per cent respectively in gross income from the two systems of pasture improvement could have been realized if calves had been offered for sale as weaners.

Grazing Intake by Beef Cattle

Cattle fitted with oesophageal fistulae, can be used to obtain an estimate of the protein and crude fibre content, botanical composition, and in-vitro digestibility of pasture selected by the grazing animal. Indigestible faecal markers can be used to estimate faecal output and, provided an estimate of the digestibility of the diet selected by the grazing animal can be obtained, an estimate of dry matter intake can be given.

Experiments were started to examine some sources of error in the collection of oesophageal extrusa and faecal marker from grazing cattle. The effects of the following factors on the quality and botanical composition of the diet selected are being measured: fasting; previous nutrition; time of collection; and animal variations. The diurnal variation of faecal concentration of chromic oxide is also being measured.

Phosphorus Nutrition in Beef Cattle

The relationship between phosphorus intake and plasma and faecal phosphorus concentration is being examined. If a satisfactory relationship can be obtained it may be possible to estimate the phosphorus intake of grazing cattle indirectly by regression analysis of plasma or faecal P on phosphorus intake. The experiment also examines the effect of non-protein nitrogen supplements on these relationships and the effect of nitrogen and phosphorus supplements on digestibility.

A second experiment concerns the relationship between the phosphorus and calcium content of pasture and of plasma, bone and hair of grazing cattle, to enable field estimation of the phosphorus status of grazing cattle.

The relationship between phosphorus content of bone as a percentage of dry, fat-free rib bone (Y) and phosphorus content of dry matter pasture (X) is given by the equation $Y = 19.248 + 3.14 \log X$ ($r = 0.58$; $p < 0.001$). Each additional level of supplemental P given resulted in increased levels of phosphorus in dry fat-free rib bone ($p < 0.01$). The relationship between plasma P concentration (Y^1) and phosphorus content of dry matter pasture (X) is given by the equation $Y^1 = 4.76 - 12.8x$ ($r = -0.24$; $p < 0.05$). Plasma phosphorus concentration was not higher in steers which received supplemental phosphorus. Calcium analyses and analysis of hair samples for phosphorus are not completed.

Deficiencies in Matured Pastures and Growth Restriction

Six Hereford steers in single pens are being fed native pasture hay. The deficiencies of the pasture which are likely to be restricting cattle growth are being defined by supplementing each steer with molasses, urea, nitrogen, phosphorus, sulphur and trace elements according to an eleven period Youdon square design.

Results are incomplete but have indicated that native pasture has a low apparent crude protein (3.5 per cent) and phosphorus content (0.08 per cent), which can be increased with nitrogen and phosphorus supplements. The apparent dry matter digestibility coefficient of the pasture is low (24.6 – 50.6 per cent) while the rumen concentration of volatile fatty acids (68.6 – 85.3 $\mu\text{mol/ml}$) in the steers has also been low.

BEEF CATTLE RESEARCH – GLEN INNES AGRICULTURAL RESEARCH STATION

Winter Nutrition on the Northern Tablelands

The winter feed supply limits beef cattle production on the northern tablelands. Previous results from Glen Innes have indicated that inclusion of oats would increase winter forage in experimental farmlets. In 1970, 12 per cent of the 34.8 hectare pasture farmlets was sown to nitrogen-fertilized oats and the cattle production was compared from three farmlets, having cattle at different stocking rates. The gross margin return was increased at the highest stocking rate (1.11 cow per ha). However, oats did not provide adequate forage for either cows or weaners and considerable supplementary feeding was required.

Further work will examine the possibility that a pasture system and a stocking rate 0.97 cows per ha would be more reliable for producing prime yearlings than a system including forage oats in a highly variable climate.

BEEF CATTLE RESEARCH – TRANGIE AGRICULTURAL RESEARCH STATION

Beef Cattle Improvement through Breeding

Conventional visual selection was practiced in the Trangie Angus Stud from its foundation in 1929 until 1962. From 1963 the opportunity was taken to demonstrate the application of selection based on growth performance to 12 months of age within a top stud. This year the herd was split to compare conventional selection with selection based on measured performance.

In the conventional selection herd, replacements will be selected visually by recognized stud breeders. In the herd with selection based on measured performance, replacements will be selected largely on the basis of gain to 12 months of age. Some attention will still be given to type.

Preliminary results following selection this year indicated that, overall, the stud breeders were accounting for only 27 per cent of the variation in final corrected yearling weight, but 61 per cent of the variation in conformation. However, in the selection of the four replacement bulls they accounted for a very high proportion of the possible selection differential for weight gain. Further trials will be necessary.



The number of beef cattle in N.S.W. this year increased by nearly one million. Farmers made heavy demands on the Department's beef cattle extension officers. They showed interest in nutrition of cattle and there were increases in supplementary feeding and lot feeding.

DAIRY CATTLE RESEARCH – WOLLONGBAR AGRICULTURAL RESEARCH STATION

Dairy Beef Production

In studies of beef production from the dairy herd the aims are to maximize the number of calves suckled per cow, minimize the length of the suckling period, and produce a calf capable of reasonable post-weaning growth on pasture.

The first experiment in which cows were suckled at zero, two, three and four calves per cow, was completed. It indicated that a cow can satisfactorily suckle three calves and that the financial returns from this system compare favourably with commercial milk production. The calves were weaned at 12 weeks and the foster cows returned to the dairy. In the second experiment, nearing completion, all cows suckled three calves but calves were weaned at 6, 9 or 12 weeks. Preliminary results indicated that calves can be weaned at 9 weeks but that weaning at six weeks is too harsh.

Tropical Pastures for Cattle Production

Studies on techniques of experimentation have indicated that, under most circumstances, an evaluation of a pasture sample using sheep as an experimental animal can be completed in about two weeks. However, factors such as the total amount of feed offered have an important influence on the results obtained. Standardization of techniques is essential.

Investigations of the nutritive value of grasses have shown that pangola (*Digitaria decumbens*) and green panic/rhodes (*Panicum maximum/chlores gayana*) are likely to have higher nutrition value than setaria (*Setaria spaciata*), and kikuyu grass (*Pennisetum clandestinum*). In kikuyu grass studies, results have been inconsistent with effects of pasture mixture, length of regrowth and rates of fertilizer application on nutritive value. The major limitation in this type of work is being able to describe the samples being evaluated satisfactorily.

Energy Sources as Supplements for Grazing Dairy Cattle

Various energy sources as supplements for grazing dairy cattle were compared in five experiments. The first examined the influence of the current level of milk production on the response of grazing cattle to a supplementary ration. The second group of experiments investigated different cereal grains and molasses as energy supplements.

Investigation of the effect of level of production on response to supplementation indicated that, up to 3 kg of supplementation, the response is similar irrespective of the level of production.

A final experiment in this series will investigate feeding of up to 18 lb of supplement per day to cows producing between 10 and 40 lb of milk per day.

There was no difference in the production response between wheat, oats, barley, maize, and sorghum. When wheat, sorghum and molasses were compared, molasses produced less milk than did either wheat or sorghum but the difference did not attain significance.

PIG RESEARCH — AGRICULTURAL RESEARCH STATION, WOLLONGBAR

Nutrition. — An experiment on the mineral — vitamin supplementation of diets for growing pigs continued. The albino rat is being evaluated as a test organism for mineral and vitamin work with the pig.

Ultrasonic determination of backfat depth. — Work with this technique on live pigs showed that it has potential value as an aid in the selection of breeding stock. The skill of the operator plays a large part in its effectiveness.

POULTRY RESEARCH — POULTRY RESEARCH STATION, SEVEN HILLS

Breeding Project (Eggs)

The egg breeding programme, commenced in 1959, continued. The 10th generation was under test.

The inheritance of egg cholesterol levels in purebred and crossbred flocks is being studied in conjunction with the N.S.W. Egg Marketing Board.

Cage Layer Nutrition

High energy layer diets tend to improve egg size and the efficiency of feed utilization. Within limits, they decrease the cost per unit energy and may reduce handling costs. However the ability of layers to adjust feed intake to maintain a constant daily intake of energy is imperfect and "overconsumption" of energy has been observed when high energy diets are given.

The magnitude of "overconsumption" with diets of from 2700 to 3300 k cal metabolizable energy (ME) per kg, and the influence of dietary energy and protein on feed intake and productivity were investigated. The application of a feed restriction programme to control overconsumption of the highest energy diet was also examined.

Voluntary feed consumption was minimal when the diet contained 2900 k cal ME per kg. Hens given diets of 3100 and 3300 k cal ME per kg overconsumed energy by 10 and 15 per cent respectively. Reduction of dietary protein according to the magnitude of "overconsumption" predicted by the literature had no influence of feed intake except when the diet contained 2900 k cal ME per kg. This result is presumed to be a response to deficiency in essential amino acid intake. Maximum efficiency of nutrient utilization was obtained with a diet containing 15.5 per cent protein and 2900 k cal ME per kg.

Egg production tended to increase with dietary energy, but not significantly. Egg size was reduced when the daily protein intake was less than 16.5 g per hen day, but no other effects of diet on egg quality were observed. Feed intake declined as the time for feed consumption was restricted. There was an unusual peak when the feed troughs were open for five hours per day. Egg production and efficiency of nutrient utilization were at the maximum when five hours feeding time was provided, but egg size was reduced. The mechanism involved was not evident but may be associated with the establishment of a recognizable pattern of restriction to initiate compensatory feed consumption.

Calcium Requirements of Pullets

The effects were investigated of increasing dietary calcium at 13, 14, 15 or 16 weeks of age, at 5 per cent egg production, and at 10 per cent egg production. There were no apparent effects on hen day production, egg weight, specific gravity, feed per dozen eggs, percentage cracks or percentage graded as 56 or 48 gram eggs.

Meatmeal Investigations

The major emphasis in recent meatmeal quality investigations has been on examination of samples of known processing history provided by the Division of Chemical Engineering, CSIRO and studies of the efficiency of the bioassay procedure.

"Overcooking", after the accepted end point, at 130 or 143°C had no deleterious effect on quality. Extended rendering at 115°C tended to improve quality to that of meatmeal prepared at higher temperatures. These results are contrary to the hypothesis that the major cause of variation in meatmeal quality is protein damage due to overheating and suggest that the quality of meatmeals is determined before the end point of rendering.

A preliminary examination strongly suggested that storage for 22 hours before rendering adversely affects quality. The extent of this effect was similar to the variation in quality observed under commercial conditions.

In studies of the bioassay procedure, the differences in protein quality between meatmeals were a maximum when 25 per cent of the protein of the assay diet was provided by the meatmeals and the diets were given *ad lib*. It appears likely that diets containing greater amounts of meatmeal provide sufficient of the limiting amino acids and mask differences between meals in available amino acids. Restriction of feed intake reduces the apparent differences in meatmeal quality.

Vegetable Protein Concentrates

Rapeseed meal replaced soybean meal at nil, 5 and 15 per cent inclusion rates, with and without adjustment for energy, in a six-treatment pilot experiment. Feed conversion was less efficient when rapeseed was included even when diets were isocaloric. Weight gain was depressed by addition of rapeseed meal but this was only significant when diets were not adjusted for energy.

Lupin meal (dehulled and ground in hammer mill) was also fed in place of soybean meal at nil, 5, 10 and 15 per cent inclusion rates. Diets were adjusted for equal energy and methioine contents. Feed conversion was adversely affected by 15 per cent lupin meal. From a correlation analysis it was estimated that inclusion of one per cent lupin meal depressed gain from 10 to 21 days by 11 grams.

Broiler Breeding Programme

Two flocks are maintained: an E and a D flock. The former is the more advanced line while the D flock is to be subsequently used as the female line. Selections each year have been for weight at nine weeks and white feathering. The birds are scored at ten days of age for type of feathering whether rapid or slow, but selection has not yet been exercised for this trait as it can be quickly brought in whilst rapid and slow feathering are both segregating in the flock. The chickens were tested in the new controlled environment sheds and appeared to grow better than in the old-type, conventional shed. Reproductive problems resulted in fewer birds than usual being tested to nine weeks of age. Artificial insemination was used for the first time.

Genetic Correlation Between Feed Conversion and Growth Rate in Broiler Chickens

The project, commenced in 1967, measured genetic and physiological aspects of feed efficiency and growth rate in broiler chickens. Growth rate and feed consumption between one and four weeks of age were determined individually using single chick cages. Estimates of heritabilities for growth rate, feed conversion ratio (FCR) and genetic correlation between these two traits were made. The combined component pooled estimate for the heritability of FCR was 0.31 ± 0.09 for males and 0.53 ± 0.10 for females, and for weight gain 0.12 ± 0.08 for males and 0.52 ± 0.06 for females. The genetic correlation estimate between weight gain and FCR was -0.39 ± 0.25 for males and -0.76 ± 0.04 for females.

Chickens in the base population were divided into three lines: A line — selected for decreased FCR (increased feed efficiency); B line — selected for increased FCR (decreased feed efficiency); and C line — randomly selected control.

There were two generations of selection. The average realized heritability of FCR was 0.38 for males and 0.32 for females with a mid-sex average of 0.35. These averages were calculated from the divergence between the upward and downward selected lines. Heritabilities calculated using the response relative to the control line were considerably more variable — the control lines were fairly small and sampling variation would have had a relatively large effect.

Realized genetic correlations between weight gain and FCR obtained from the A lines were considerably larger and less variable than those from the B lines. The average realized genetic correlation in the A lines was -0.951 for males and -1.100 for females while in the B lines the average genetic correlation was -0.247 for males and $+0.275$ for females. Apparently selection for higher efficiency is much more effective in increasing weight gain than selection for lower efficiency is in decreasing weight gain. The average realized genetic correlation calculated from the divergence between the two selected lines was -0.518 . These realized genetic correlations were calculated using the base population estimate for the heritability of weight gain since it was not possible to calculate the realized parameter from the selection experiment.

Using the average realized parameter values of 0.348 for the heritability of FCR, -0.518 for the genetic correlation and the base population average estimate of 0.313 for the heritability of growth rate, direct selection for FCR was estimated to be twice as efficient in improving FCR as correlated response to weight gain selection. Some form of direct selection for efficiency was therefore indicated.

Four separate experiments were carried out to determine the relationship between feed efficiency and a number of body composition and physiological characters. The more efficient chickens were faster growing, had relatively smaller viscera, a possible slower rate of feed passage along the alimentary tract, lower per cent protein, ash and water and a higher per cent of fat in the carcass than the less efficient chickens. There was a positive relationship between feed efficiency and degree of feathering in female chickens. Where selection for increased feed efficiency is practised, the concurrent increase in carcass fat is responsible for improving the energetic efficiency to a greater degree than is measured by the improvement in the feed conversion ratio.

It is suggested that should there be a general move commercially to rear the sexes separately and to feed diets suited to their different nutrient requirements. Selection for growth rate and feed efficiency should be carried out with the males and females under the appropriate dietary regimes. A reduction in the emphasis on bodyweight selection by the incorporation of a measure of feed efficiency should have the effect of maintaining, if not increasing, current economic gains per generation and prolonging reasonable economic gains by delaying the possible plateau in bodyweight.

Broiler Breeder Dietary Levels

This experiment was aimed at determining the optimum feed restriction pattern during the rearing and laying periods for two commercial strains of broiler female pullets, one strain being heavier than the other. Birds were fed rearing diets from ad lib to 40 per cent of ad lib and laying rations from ad lib to 80 per cent of ad lib. The rearing treatments were imposed at 20 weeks of age and concluded at 21 weeks of age when the laying treatments commenced.

There was no difference between strains in age at sexual maturity. A significant effect of rearing treatment on age at sexual maturity was apparent — as expected. The delay was approximately seven weeks between the ad lib-ad lib groups and the 40 per cent — 80 per cent restricted groups. There was also an effect of laying treatment on age at sexual maturity in rearing groups subject to the more severe restriction.

Mortalities during rearing were due to mainly Marek's disease, nephrosis and coccidiosis. There was no indication of treatment or breed effect in the incidence of Marek's disease but the incidence of nephrosis was higher in the heavier strain and in the birds fed ad lib and 40 per cent of ad lib. Mortality was directly related to the current phase of nutrition and to plane of nutrition during the rearing period. Body size and fat deposition were thought to be involved. The rearing treatments had marked effect on bodyweight, the ad lib group being nearly twice as heavy as the 40 per cent group.

There were laying treatment effects on per cent rate of lay at 30 weeks, particularly in those subject to the more severe restrictions during rearing. The rate of lay of the lighter strain was overall higher than that of the heavier strain, particularly in groups restricted during laying. Per cent hatchable eggs were substantially higher in the heavier strain. Hatchable egg production increased with an increase in rearing restriction in the lighter strain only. In these birds, hatchable egg production decreased with an increase in laying restriction.

Choline in Chick Diets

Work with choline is intended to develop the method of choline assay, survey the choline content of local feedstuffs and to obtain a better estimate of the requirements of broiler chickens.

Contrary to a previous experiment, choline supplementation of the basal diet had no effect on chick growth. Similarly the hyperexcitability state induced by excess choline in the earlier experiment was not evident until the chicks were nine weeks of age and its severity was greatly reduced.

Stocking Density of Broilers

Stocking densities of 0.038, 0.040, 0.045, 0.054 and 0.063 square metres per bird were compared. Waterer space was the same in each pen (9.2 square metres) but the number of feeders per pen provided about 2.5 cm of feeder circumference per bird. There was no significant differences in liveweight due to treatment. Average liveweight at nine week was 1.73 kg — males averaged 1.91 kg and females 1.58 kg.

Feed conversion ratios (FCR) of broilers in the two most densely stocked treatments (average 2.33) were significantly better than those on other treatments (average 2.46). Income over feed and chick costs per bird was consequently better with the more heavily stocked treatments (average 14

cents per bird) than the other (average 12 cents per bird). The retention of body heat in heavily stocked pens would be a major influence in the improved efficiency. Unfortunately the treatments were not sufficiently severe to enable an optimum stocking density to be determined in controlled environment houses.

PASTURES' PROTECTION SECTION

Staff

Professional staff of the section consisted of a Pastures Protection Officer, a Senior Field Officer and three Field Officers.

Staff employed by Pastures' Protection Boards at June 30 with 1970 figures in brackets was: Veterinary Inspectors — 33 (36); Secretaries — 58 (59); Rangers — 66 (65); and Rabbit Inspectors — 77 (77).

Rabbit Control

The Rabbit Control Advisory Committee met regularly. It also held a special meeting to evaluate control measures. It was decided the Committee should endeavour to stimulate interest in rabbit control, particularly where present efforts are not adequate or effective. A proposal was formulated to strengthen the Departmental staff engaged in rabbit control and research and to encourage Directors of Pastures Protection Boards to take greater interest in the rabbit situation in their districts.

Bran/pollard pellets were compared with chopped carrots as vehicles for sodium fluoroacetate (1080) rabbit poison. Effectiveness was similar except in one trial when heavy rain fell and carrots were better. Many landholders started using pellets in preference to carrot.

Control of Plague Locust (Chortoicetes terminifera)

Swarms were active during the latter half of 1970, mainly in the Cobar and Bourke districts. Hatchings in the Bourke district were affected by dry conditions and many failed to develop. Because of more favourable conditions in the Cobar district, large numbers of locusts survived and later formed into dense marching bands which were effectively treated. However, extensive hatchings occurred in the Hillston and Hay Pastures Protection Districts and developed into massive flying swarms during the autumn, involving the Hillston, Hay and Narrandera Districts. Effective treatment of the swarms was difficult because of the lack of information concerning the existence of the infestation in the first place and the extent of the hatchings. Several swarms were sprayed from aircraft with satisfactory results, although it was not possible to prevent very heavy egg laying over the whole area. In addition, some migration occurred to surrounding areas, and loose swarms were observed in other areas in the south west. No serious infestation was reported from any other part of the state although reports indicated that loose swarms which occurred in the central-west and north west could cause problems in 1971-72.

During the autumn outbreak, 3,000 gallons of 15 per cent lindane were distributed by Pastures Protection Boards in the Riverina district for use by landholders to spray hoppers on the ground.

Treatment of adult swarms by spraying from aircraft between March and April was supervised by officers of the Department. Chartered agricultural aircraft fitted with boom spraying gear calibrated to distribute technical fenitrothion and technical maldison at ultra low volume rates were used to control migration. Treatment was applied directly to flying swarms to prevent or retard migration. The residual properties of technical fenitrothion were used treating areas where it was expected that swarms would settle.

A total of 16,000 lb of technical fenitrothion and 32,000 lb of technical maldison was applied by aircraft during autumn. In addition, 4,400 lb of technical fenitrothion was used in a research project at Cobar.

Motor vehicles and spotter aircraft were used to locate swarms, which sometimes extended for several miles. Spraying aircraft were directed by radio. Even when the pattern of treatment of a particular swarm was established, it was sometimes necessary to modify treatment according to changes in swarm patterns or wind velocity. Helicopters were used in 1969-70 but were very expensive to charter. This year a combination of a Cessna 180 aircraft and a small trail motor-cycle was used to carry out random surveys in the Riverina district. The motorcycle was unloaded at landing strips or claypans and used for transects in a radiating pattern from the landing area.

Staff Training

Two schools of instruction in the handling and using of 1080 poison and general rabbit control were held for rabbit inspectors. A more comprehensive refresher course at Hawkesbury Agricultural College was restricted to inspectors who had attended a 1080 school and then completed at least 12 months service with a Board. Schools in rabbit control were also arranged for staff of the National Parks and Wildlife Service and the Forestry Commission.

Travelling Stock Reserves

Applications for the transfer of 141 portions of travelling stock reserves were dealt with; only two were outstanding at the end of the year. A sum of \$50,000 was made available for the acquisition of land to permit relocation of reserves which have become unsuitable because of urban development or the relocation of highways.

Registration of Brands

Registration of large stock brands and sheep brands and earmarks has been kept up-to-date. Many large stock brands were re-registered in the names of the present owners, as a result of information obtained from applications for cattle tail tag identification numbers. The publication in the Government Gazette of particulars of registered sheep brands and earmarks was stopped.

Pastures Protection Boards were asked to examine registers of sheep brands and earmarks to eliminate entries which are no longer required because of change of ownership or other reasons. The Committee which investigated the registration of brands recommended that the registrations of all existing large stock brands be cancelled and that users of brands be required to re-register the brand now in use. Existing proprietors of brands would be given preference in the re-registration of the brands.

Tail Tagging

The numbers of certificates and exemption licences issued during 1970-71 were: applications by occupiers — 3,794 new, 586 re-allotted; applications by non-occupiers — 238 new, 2 re-allotted; applications for exemption — 788. The totals to June 30, 1971, were: application by occupiers — 53,809; application by non-occupiers — 1,612; and application for exemption — 3,904.

DIVISION OF DAIRYING

GENERAL

STAFF

Administrative Professional Staff Changes

Following appointment of Mr D. W. Crowfoot, formerly Chief, Division of Dairying, as Deputy Chairman of the Dairy Industry Authority, Dr G. J. Smith was appointed Chief of the Division and Mr E. G. McLaren, Deputy Chief from July 1, 1970. Mr D. R. Scott was appointed as Principal Dairy Officer (Extension), Mr R. L. Auld as Principal Dairy Officer (Herd Improvement), Mr B. P. Mullins as Assistant Principal Dairy Officer (Regulatory) and Mr R. Gamsby as Assistant Principal Dairy Officer (Milk Products).

Livestock Officers (Dairy Cattle)

An additional Livestock Officer (Dairy Cattle) was appointed to a District making a total of six of the 13 administrative Districts staffed by officers with specialist training for extension work in dairy livestock. An additional five trainees were appointed as Livestock Officers (Dairy Cattle). There are now 22 officers in the herd improvement section.

Post-Graduate Study

Livestock Research Officer (Dairy Cattle), A. K. Rathore was awarded the degree of Doctor of Philosophy by the University of New England. Mr B. Mullins, Dairy Officer, was awarded the Hawkesbury Diploma in Rural Extension.

THE INDUSTRY

Seasonal Conditions

Drought prevailed throughout the major dairying districts during the winter and spring of 1970. Soaking rains were not received until December and January. Thereafter rainfall continued to be above average on the north coast and caused minor flooding and difficult grazing conditions. On the far south coast the biggest flood on record occurred in February, 1971, causing damage and heavy losses to the Bega cheese factory; only minor damage occurred on farms. Production was also affected by a widespread outbreak of ephemeral fever during the year.

Industry Trends

The number of dairy farms declined to 7,943, a reduction of 1,118 for the year. The rate of decline was lowest in the upper Hunter area and highest on the far north coast. This decline in the number of dairy farms has been accompanied by a continued swing to beef production. The farms remaining in the industry are tending to become bigger and are continuing to make a demand on the Department's herd recording scheme — a basic requirement for planned efficiency.

With the reduction in the number of dairy farms, dairy produce factories have had difficulty in securing sufficient milk to operate efficiently. No difficulty is particularly evident in the Hunter Valley. Several dairy companies ceased to operate and others have amalgamated with larger companies.

On the far north coast sowings of tropical pasture continued to increase while, on the red soils, top dressing of kikuyu with up to 100 lb of nitrogen per acre provided valuable grazing well into the winter.

The number of farms with refrigerated bulk milk tanks continued to increase. There were 2,370 tanks on farms in 1969, 3,030 in 1970 and 3,526 in 1971 so that 44 per cent of all farms now have refrigerated tanks.

A trend to the manufacture of non-traditional varieties of cheese continued even though supplies of milk for manufacture were restricted.

One factory changed from the use of 100 box, stainless steel churns to continuous butter making.

Special Projects

North coast feed year assistance scheme. — In the fourth year, which ended September 30, 1970, there were 2,708 applications for assistance under the scheme. The numbers of applications in previous years were 3,816 in year one; 3,408 in year two; and 3,150 in year three. The percentage of eligible farmers applying for assistance has varied little; it was 76, 73, 74 and 70 per cent in the four years. The percentage has ranged between 60 and 90 per cent according to the district.

Farmers use the scheme to improve feed supply for their herds. According to local circumstances, the scheme may apply to: top dressing of kikuyu pastures with nitrogen; sowing of oats with heavy fertilizer application; mixed tropical pastures on high country; or maize for hammer-milling. Average areas treated are 19 to 20 acres, the maximum area for which subsidy is paid in any one year.

The scheme has enabled contact with farmers at the Department's offices and encouraged discussion of farm problems. In addition farmers who have made full use of the scheme have improved their knowledge of fodder provisioning and improved or consolidated their overall position.

Mastitis control programme. — The mastitis control programme planned by a committee representing five Divisions of this Department, the University of Sydney, and the N.S.W. Dairy Industry Authority continued. In the first stage the principles of mastitis control in the herd are being applied. The response to control measures is being assessed through changes in the incidence of mastitis changes in production and calculation of costs and benefits. The first stage will provide the base for an educational second stage aimed at the wide application by industry of these principles.

The programme is supported by diagnostic laboratories at Rydalmere, Glenfield, and Wollongbar. Individual demonstration farms are supervised by a Veterinary Officer or Veterinary Inspector and a Dairy Officer.

Herds for the demonstration were selected in spring, 1968, and preliminary samples for the rapid mastitis test (R.M.T.) were taken. The control programme started January, 1969, and the last of the individual demonstrations began in November, 1969. Of the 40 demonstration herds selected, five withdrew for various reasons.

Detailed records have been kept on each herd to assess the response to control measures. In the base period, the bacteriological status of each quarter was established using two samplings one month apart. Antibiotic sensitivity test on pathogens isolated from these quarters determined the drug to be used in the control period. In the control period R.M.T. have been done monthly and bacteriological analysis three-monthly on milk from R.M.T. positive quarters. Bacteriological analysis of all quarters of all cows was carried out after completion of 12 months and 24 months of the control period.

At the end of the first lactation, all quarters of all cows were given dry period therapy and at subsequent drying off times only R.M.T. positive quarters have been treated.

There has been a marked drop in both the incidence of pathogens and the incidence of R.M.T. positive quarters. For the 18 farms that had completed 24 months into the control period by the end of June, 1971, the percentage of R.M.T. positive quarters had fallen from 36.4 in the base period to 14.7 at 12 months and 14.6 at 24 months. Similar or greater declines had occurred in the incidence of pathogens.

The programme will be continued until the majority of cows have had two complete lactations. The last demonstration will conclude in January, 1973.

The N.S.W. mastitis control programme has aroused interest locally, interstate and overseas. Five conferences have been held to co-ordinate the programme and to review progress. The Veterinary Advisory Officer (Mastitis) of the New Zealand Department of Agriculture participated in one of them. During the International Dairy Congress opportunity was taken to arrange a meeting of mastitis workers throughout the world. Professor A. Tolle was the guest lecturer.

Bega dairy demonstration farm. — The Bega High School farm was transferred to the Department of Agriculture in January, 1970, and plans were prepared to develop the property as the Bega Dairy Demonstration Farm. The objective is to demonstrate that an economic one-man dairy farm can be developed using the soundly-based management information now available.

Finance for the establishment of the property has been provided by a loan of \$15,000 from the N.S.W. Treasury. The loan is being serviced in the normal way. The property is operating on a special deposits account and is thus as close to a commercial project as possible. The basic herd was provided by cattle transferred from the Department's studs at Wagga and Grafton. A quota of 50 lb of butterfat per day was granted by the Bega Co-operative Dairy Company.

An experienced dairy farmer entered into a contract with the Minister and commenced to farm the property in September, 1970. Milk production commenced in the first week of October, 1970. A District Advisory Committee comprised of three local farmers, District Dairy Officer, District Agronomist, Regional Economist and Regional Supervisor (Chairman) is available to offer the farmer advice on management aspects and to make recommendations to the Department on policy aspects of the project.

Production reached the quota level late in 1970 and has been maintained at about that level since. There is every indication that the development budget will be met, and possibly exceeded, in the first year.

EXTENSION, EDUCATION AND REGULATORY SERVICES

Quality of Dairy Products : Grading and Quality Investigations

Butter

Grading services. — The Division's dairy produce graders made regular examinations of butter and cheese manufactured by N.S.W. factories and received at Sydney, Newcastle, Canberra and Wagga for distribution and storage prior to sale on the local market. Samples from Canberra and Wagga were sent to Sydney for grading. Trained grading officers are stationed at Newcastle and Lismore where all butter for sale or storage in these districts is graded.

Details of the gradings were supplied to distributing agents, factory managers and District Dairy Officers. This information is basic to the quality control and extension work of the Division's extension officers.

Statistics from the butter grading were used as the basis for the Order of Merit of the N.S.W. Department of Agriculture and the Continuous Grading Competition of the Royal Agricultural Society of N.S.W.

Large quantities of butter and cheese were imported to N.S.W. from other States, mainly Victoria, to supplement local production. At the request of agents, the quality was checked before distribution.

Samples of butter representing 1,575,961 x 56 lb boxes were graded whilst 5,729 samples of cheese were also examined. Other products such as butter oil, dried milk products, cottage cheese, yoghurt and margarine were examined and reported upon from time to time as requested by manufacturers and distributors.

Biological and chemical surveys. — Butter samples were taken regularly for biological examination by the Biological and Chemical Research Institute. Chemical analyses were limited because the position of dairy chemist was vacant for long periods. Results of biological and chemical analysis were forwarded to District Dairy Officers and factory managers for information and action where necessary.

Surveys of butter processing plants. — Regular surveys were made of butter processing plants and samples were forwarded to the Chief Biologist for analysis and report. Reports were discussed with plant managers and remedial action was taken where necessary.

Special quality investigations. — Special investigations into various quality problems at factories were undertaken with the co-operation of District Dairy Officers. The Biological and Chemical Research Institute participated where necessary.

Surveys of retail butter: quality control. — The quality of butter at retail and consumer level was checked by regular surveys in the Sydney metropolitan and country areas. Samples were subjected to sensory grading and biological and chemical analyses. Results of these surveys were made known to industry organizations and any irregularities were brought to the notice of manufacturers and distributors.

Milk Products Other than Butter

Cheddar Cheese. — The quality of cheddar cheese varied during the year. Factories that followed the Division's policy in relation to grading standards and sediment in the raw milk supply continued to improve quality and commanded premium prices for 9–12 months matured cheese. In other, smaller factories, which did not grade milk to the Division's standards regularly, quality varied greatly. In most cases the cheese would not store for more than three months.

Varieties other than cheddar. — Other cheese varieties manufactured were ricotta, romano, mozzarella, provolone, feta, gouda, edam, pecorino, blue vein and cheedam, all of which had been made in previous years, and three additional varieties — pastarella, sardo and scamorze. The production of camembert was discontinued. Production of varieties other than cheddar was 161,942 lb greater than in the previous year.

Cottage cheese and cultured milk products. — The production of these products continue to increase, despite a fall in total milk production. The quantities manufactured were: cottage cheese — 1,710,000 lb; yoghurt — 10,446,050 lb; and cultured buttermilk and cream — 5,752,000 lb.

Imported cheese. — For the year ended June 30, 1971, 4,826,826 lb of cheese made up of 118 varieties including cheddar, was imported through the port of Sydney. This was 1,301,046 lb less than the previous year but the number of varieties imported increased by 65.

Processed cheese. — Production of processed cheese declined to 3,723,787 lb which was 188,252 lb less than the previous year.

Other products. — Production of milk powders declined but production of condensed milks increased by approximately 2 million lb and production of cream mixture increased by 31,406 gals or approximately 43 per cent.

Ice cream and frozen milk confections. — Production of ice cream, soft serve, thick milkshakes and other frozen milk confections continued the decline shown over the past four years.

New products. — "Sprade", a product used for cake fillings and topping appeared in production figures for the first time this year. Production was 822,100 lb.

Biological survey of cheese. — A total of 121 samples of cheese from N.S.W. factories, 50 more than last year were examined in a survey in conjunction with the Biological and Chemical Research Institute. The six additional factories included in the survey this year were metropolitan factories making varieties other than cheddar.

The percentage of satisfactory coliform counts declined from 81.7 in the previous year to 71.1 while the percentage of satisfactory staphylococci counts improved from 61.0 to 76.9. The percentage satisfactory in both counts remained the same as last year at 56.2. Although the 49 samples of non-cheddar varieties were mainly responsible for the decline in satisfactory coliform counts these varieties did improve during the year.

Chemical survey. — Of the 106 samples of cheese (45 more than last year) submitted for analysis, only 19 were satisfactory by the standard set by the Pure Food Act: 77 were unsatisfactory due to sediment, 18 due to high moisture, and 12 failed the phosphatase test.

Special investigations. — Investigations were carried out on milk quality and milk powders for export. The reduction in thermoduric bacteria in the milk supply resulted in improved powder quality of milk powder for export.

Activities of District Officers

A Summary of Extension and Regulatory Activities

Activities of the country-based officers of the Division in their extension and regulatory duties are summarized as follows:-

Farm visits	10,696
Demonstrations and trials	82
Field days	49
Attendance at field days	1,753
Meetings attended	254
Talks on radio and television and at field days	623
Press articles	323
Judging at shows and competitions	104
Tutorial classes conducted	106
Schools, conferences and courses attended	142
Factory visits	3,608
Hours spent in factories	8,423
Remedial orders and warnings issued to factories	21
Butter samples collected	105
Cheese samples collected	217
Whiteside tests carried out	26,522
Herds checked with rapid mastitis test	226
Milking machines checked for efficiency	1,306
Other visits — shops, margarine samples etc.	52

Discussion Groups

Dairy officers continued to work with farmers' discussion groups and 11 groups were active. The Division of Dairying has now included extension through discussion groups in its policy guidelines for extension officers and the Division of Extension Services will provide advice on the formation of groups.

Journal — Dairy Topics

The journal Dairy Topics continued to be issued free to registered dairy farmers in N.S.W. and to people closely allied with the industry. It was changed from a bi-monthly to a quarterly publication following an increase in postage rates.

A steady flow of technical articles for publication in Dairy Topics was received from Dairy Officers and Livestock Officers (Dairy Cattle). In addition articles were received from officers of the Divisions of Plant Industry and Animal Industry. Regular contributions on livestock health were commenced by the Principal Veterinary Officer (Extension). An article on voltage leaks in milking machines was the most comprehensive on this subject yet published in Australia.

Dairy Farm Management Competition

Conditions for the dairy farm management competition sponsored by Country Life newspaper and the Dairy Industry Authority of N.S.W. were revised. The new competition, to begin in 1971-72 will place more emphasis on record keeping and analysis of farm records. Particular attention will also be paid to the standard of dairy buildings, hygiene and the quality of produce.

Judging at Shows

The Principal Dairy Officer (Butter) was one of a panel of three to judge the dairy produce competitions held in conjunction with the 18th International Dairy Congress. Officers of the Division judged dairy produce at the Sydney Royal Show, Newcastle Show, North Coast National Exhibition and at other shows. They also judged competitions associated with the annual conference of the Australian Institute of Dairy Factory Managers and Secretaries.

DAIRY INDUSTRY ACT MATTERS

The Dairy Industry Act, 1915

In accordance with a recommendation from the Standing Committee on Agriculture, The Division is revising the Dairy Industry Act to achieve greater uniformity between states and to bring it up to date. Suggested modifications and changes have been forwarded to Industry for comment.

Sections of the Dairy Industry Act concerning margarine have not yet been considered because further information from the Australian Agricultural Council and the National Medical Health and Research Council is awaited.

Dairy Produce Factories

Currently there are 102 dairy produce factories registered in N.S.W., many of which have multiple registration.

Registrations this year were: margarine, table and cooking - 6; margarine, cooking - 2; butter - 37; cheese - 34; milk powder - 21; receive milk and other purposes - 61.

Inspections of factories by District Dairy Officers proceeded satisfactorily. Orders were issued to bring factories up to the required standard where necessary.

Dairy Produce Stores

There were 201 registered dairy produce stores in N.S.W. at June 30, compared with 224 in the previous year. Annual inspections of stores in country districts were completed and inspections of metropolitan district stores almost completed at the end of the year.

Code of Building Practice

A Commonwealth code of practice aimed at quality control is being compiled. Victoria is the collating authority. All States were invited to submit views on various aspects of factory hygiene and dairy building design and layout.

Certificates and Schools

Photometric (Milko-Tester) method of determining fat percentage in milk. During the year 40 candidates were examined in the use of the Milko-Tester; 37 milk testing certificates were endorsed.

Dairy science schools. - Details of dairy science schools and certificates issued were as follows:

Certificate	Number of Schools	Candidates Examined	Certificates Issued
Milk grading factory certificate	14	42	37
Grader/driver certificate		76	54
Cream grading certificate	4	33	28
Butter making certificate	6	25	25
Milk testing certificate	10	102	83
Cream testing certificate		102	74
Cheesemaking certificate	7	27	25

Dairy Technology students at Hawkesbury Agricultural College are included in the numbers of candidates examined and certificates issued.

THE DAIRY INDUSTRY AUTHORITY ACT, 1970

Dairy Officers continued to hold delegated powers under the Dairy Industry Authority Act. Close liaison was maintained with the Authority.

THE HERD PRODUCTION IMPROVEMENT SCHEME

Herd Recording Staff

The establishment strength provides for 129 positions (106 herd recorders, 12 relief recorders, 11 herd organizers). At the time of this report 119 positions are occupied (99 recorders, 10 relief recorders, 10 herd organizers) one less position than last year.

Farm Milk Meters for Herd Recording

During the year a further 42 herd recording units were equipped with milk recording meters to replace vacuum milking machine buckets, making a total of 80 units out of 100 so equipped. The remaining 20 units will be converted in the early part of the 1971–72 year. Both farmers and Herd Recorders acceptance of this innovation have been excellent.

Official Recording – Registered Pure Bred Dairy Cattle

These statistics are for the year ending June 30, 1970. Membership of this section reached 330, an increase of 15 over 1968–69. The number of cows completing records of from 4 to 10 months showed a proportional increase to 10,137, which was 240 cows more than the previous year. A total of 11,125 were recorded. The average production by cows in this section was the highest ever achieved at 9,117 lb of milk, 4 per cent butterfat test and 369 lb butterfat.

Group Recording Section – Grade and Pure Bred Dairy Cattle

Under group herd recording owners of grade herds, and owners of stud herds who do not wish to be involved in the expense or publicity of the official section, are able to have the milk and butterfat yield of the individual cows in the herd measured and recorded. The production figures obtained are supplied to the member on a monthly and a lactation basis to assist him with management problems, such as feeding, breeding and culling, which require a knowledge of each cow's production.

In the year ending June 30, 1970, 90,759 cows were recorded in the group recording section. Of these, 79,522 completed normal lactations of from 4–10 months and produced an average of 6,746 lb of milk, 4.18 per cent butterfat test and 282 lb butterfat; 3,845 completed abnormally short lactations; and 7,392 cows were recorded for part lactations. Records of the latter two groups are excluded from statistical tables.

Herds Recorded and Cow Numbers per Herd

The total of 1,508 herds recorded was 155 less than the previous year. These herds were spread through the recording units recording official and group section cows. The average number of cows completing lactations in each herd was 60. This figure does not include those cows which were recorded in the official section in a small proportion of these herds.

Analysis of Information from Herd Recording

The information obtained from both official and group recording sections is analysed to provide surveys of all bulls with daughters recording. This information, compiled into R.G.V. (Relative Genetic Value) ratings, is made available to any farmer who requests it. More importantly, the survey for bulls standing in the state's Artificial Stock Breeding Centres identify bulls that are likely to raise the genetic potential for production in the herds in which they are used. This information is published separately.

Records of the Herd Recording Scheme

Complete reports on the management and statistical data derived from the herd recording scheme are published in "Recording of Pure Bred Registered Cows in N.S.W.", volume 35 and "Group Herd Recording 1969–70".

Alternative Procedures in Herd Recording

Methods to lower costs of herd recording or at least to stop costs increasing, are being investigated. One method is the use of optical scanning procedures to improve flow of data to the computer.

Solids-Not-Fat Recording

Analysis of the data from the solids-not-fat herd recording units continued. One unit is in the Windsor district and the other in the Nowra district. For the year ended June 30, 1970, 1,866 records were analysed. The results supported previous findings.

Protein Testing

In studies of the protein testing of milk, the five government herds are now forwarding monthly samples from individual cows to Hawkesbury Agricultural College for analysis on the Protein Tester. This work is continuing at parallel with fat and solids-not-fat testing. Correlation figures will be available shortly.

Dairy Cattle Nutrition

The officer engaged in dairy cattle nutrition was seconded to CSIRO, Division of Animal Nutrition, for further training. The Department agreed to the Division of Animal Nutrition using the New South Wales Department of Agriculture's herds for a short research project that will further test the new technique of rumen by-pass of nutrients, particularly proteins.

Dairy Industry Artificial Breeding Advisory Board

The N.S.W. Dairy Industry Authority Act 1970 provided for the establishment of an Artificial Breeding Advisory Board to advise the Minister on the development of the dairy and beef cattle artificial breeding scheme operated by the Authority and to suggest ways in which this system and the Department's herd recording scheme could be co-ordinated.

The Board includes two officers of this Department. Four meetings were held during the year and 14 minutes of recommendations were forwarded to the Minister. The most important of these dealt with the establishment of a properly planned and executed bull proving scheme.

Sire Survey

All bulls whose progeny are recorded under the Herd Production Improvement Scheme, continued to be surveyed. Although no formal bull proving scheme is in operation yet for bulls being used in artificial breeding, it has been possible to provide relative genetic values (R.G.V.) for them. The advantage is enormous. It encourages increased use of outstanding animals and contract mating for bull breeding to give the artificial breeding. In addition, animals whose R.G.V. has proved unsatisfactory have been culled from artificial breeding stations.

Calf Marking Scheme

At the year ending June 30, 1970, 15,023 calves in 740 herds were tattooed by herd recorders as part of the calf marking scheme under the Department's Herd Production Improvement Scheme. Of these calves, 4,021 were born to sires located at artificial breeding stations. The progressive total of calves tattooed in the scheme has now reached 204,650.

GOVERNMENT HERDS

The Department's dairy cattle herds continued to be among the leading studs of their respective breeds in the State. Production was maintained at a high level and stud bulls were keenly sought by commercial dairy farmers, other government departments and artificial breeding institutions.

Poll Jersey and A.I.S. Studs - Grafton Agricultural Research Station

The decision to develop Grafton Agricultural Research Station as a major beef cattle research centre necessitated removal of the sires of the Poll Jersey stud and the A.I.S. stud at that centre. It was decided to discontinue the Poll Jersey project and to transfer the A.I.S. stud to another centre.

The main Poll Jersey herd will be transferred to the Bega demonstration farm, six selected animals will be transferred to the main Jersey stud at Wagga Agricultural College, and the remaining animals will be transferred to Wollongbar Agricultural Research Station for research use. Because the

prime purpose of the Bega demonstration farm is to demonstrate economic production from a one-man unit it would not be possible to continue the herd as a registered stud there.

The A.I.S. stud will be transferred to the C. B. Alexander Agricultural College to displace a similar number of animals which will also be transferred to Wollongbar Agricultural Research Station for research purposes.

Production

The highest average production of the Department's herds was again attained at Hawkesbury Agricultural College where 61 Friesian cows averaged 13,561 lb milk, 3.7 per cent test and 505 lb butterfat per cow.

The following table shows production averages for the Department herds for the year 1969-70. (the latest figures available).

	Milk	Test	Butterfat	Number of Cows
Hawkesbury Agricultural College	13,561	3.7	505	61
Grafton Agricultural Research Station				
A.I.S.	9,070	4.4	396	43
Poll Jersey	7,692	5.0	382	46
Wagga Agricultural College	8,053	5.1	410	50
Yanco Agricultural College	8,709	5.2	456	24

Stock Sales

There was keen demand again for Friesian cattle, 23 head being sold for a total of \$6,890. The demand for other breeds was similar to that of the previous year with the exception of the Poll Jersey stud where only one bull was sold. Altogether, 46 stud animals were sold; 42 bulls and 4 females, for a return of \$11,047. In addition to these sales, 118 animals were transferred to other government institutions.

Bulls in Artificial Breeding Centres

There were nine bulls owned by the Department in use at artificial breeding centres in N.S.W. A further four Friesians were accepted by the Dairy Industry Authority and will be available for A.B. shortly. A number of females from all studs were either mated or selected for contract mating as a further means of supplying animals of the required genetic quality for artificial breeding.

Exhibits at Shows

Teams of Friesians, Jerseys and Guernsey cattle, respectively from Hawkesbury, Wagga and Yanco Agricultural Colleges, were exhibited at the Sydney Royal Show, with each team gaining a share of the awards.

Country shows at Lismore and Grafton were supported by A.I.S. exhibits from Grafton Agricultural Research Station. Hawkesbury, Leeton and Wagga shows were supported by teams from Hawkesbury, Yanco and Wagga Agricultural Colleges respectively.

DAIRY RESEARCH AT HAWKESBURY AGRICULTURAL COLLEGE

General

Reorganization of the dairy research group stationed at Hawkesbury Agricultural College was commenced. The group will work as operational teams, supported by appropriate sections of the College. The teams will be capable of concentrating sufficient effort on a given front to achieve positive results.

FOOD PRODUCTS RESEARCH

New Foods

A new major project "The use of milk and milk products in new foods" is being supported by the Australian Dairy Produce Board. A team of three research officers will be concentrating on this project.

Continuous Fermentation

Further experimentation on the continuous fermentation plant elucidated the problem with the bacterial organism being used. A run of 200 hours and two runs of 100 hours were accomplished without problem using a different organism. Design characteristics for a commercial application were obtained and some developmental work on the product was carried out.

Processed Cheese

The processed cheese project was terminated. A full report will be submitted to the Australian Dairy Produce Board and will be published by or on behalf of the Board as a monograph "Studies on Processed Cheese Manufacture". A condensed version will be published as a processed cheese manual.

Flavourings of processed cheese and bitterness in processed cheese were investigated. Assistance was given to several companies manufacturing processed cheese.

Manufactured Meat

A project to examine the use of calcium co-precipitate (milk protein) to substitute for some of the common non-meat additives used in the manufacture of small goods was completed. The project was in two parts. The first was a study of the emulsification capacity, emulsion stability and moisture holding capacity of the different types of co-precipitates compared with those of other non-meat protein additives (soya and sodium caseinate). The second part of the project concerned the manufacturing aspects of the co-precipitate in comminuted meat and the study of the parameters controlling the use of co-precipitate in manufactured meat.

Milk Preservatives

The preservative action on milk of four chemicals, methylphydroxybenzoate, chlorobenzoate, naphthol and potassium dichromate, as alternatives to mercuric chloride was investigated in preliminary experiments. Further experiments are planned.

DETERGENT RESEARCH

Standards.

Close liaison continued with the Dairy Detergents and Sanitisers Committee of the Standards Association of Australia. The research group was asked by the Committee to recommence work on the cleaning performance tests for detergents. This work produced two satisfactory techniques for testing general purpose and acidic dairy detergents in the laboratory. Work on a corrosion test is in progress.

Cleaning Systems for Milking Machines

The recirculation simulator was modified to allow evaluation of a greater number of parameters. Preliminary work was done on the bacteria to be used as test organisms in the machine. The organisms to be used have been selected and techniques of use in the simulator are being developed. Methods of assessing the physical properties of the materials under test are being investigated.

Post Milking Teat Dips

An evaluation of seven post milking teat dips was completed at Hawkesbury Agricultural College. The evaluation has been extended to three farms.

Hard Surface Sanitizers

Laboratory, *in vitro* tests of hard surface sanitizers were discontinued because reproducibility was poor. Work is now proceeding with a modified method.

BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE, RYDALMERE

ADMINISTRATION

OVERSEAS TOUR OF DIRECTOR OF THE INSTITUTE

The Director was overseas from July to November to investigate advances in pesticides residues research. Particular attention was paid to laboratory organization, pollution, new scientific equipment, and, especially in U.S.A., to medium to large scale field monitoring organizations. Useful data on pesticides residues techniques were obtained in U.S.A., United Kingdom, Switzerland and Japan. Other gains were a much clearer assessment of the importance of polychlorinated biphenyl (PCB) compounds in known pesticide pollution situations, analytical data for multiple residue determinations involving PCB compounds, and procedures for systematic monitoring of soils and plants which have formed a foundation for a new phase of pesticides residues investigations at the Institute.

Discussions with wildlife authorities in U.S.A. and the United Kingdom were also of value. They highlighted the analytical expertise increasingly becoming available to their field officers, and the more comprehensive approach being taken to pesticide usage.

Information about policy and organization in control of pollution by pesticides, particularly from the Food and Drug Administration, U.S.A., has already proved of considerable value in planning future residues research in this Department.

Discussions with extension scientists in Government agricultural institutions in U.S.A., Canada, United Kingdom and Germany were valuable. Topics included their role in relation to research personnel and the question of the balance between research and extension which was receiving close attention in the United Kingdom at the time of the visit.

Studies of "mass production" procedures in chemical and biological laboratories in U.S.A., New Zealand and Holland were rewarding. This was especially so where such procedures were integrally linked with a central data processing unit capable of much higher output than ordinary single automated laboratory equipment, some of which is currently available at Rydalmere.

Attendance at the 5th Session of the Codex Committee on Pesticide Residues, held at The Hague during the period 28th September to 6th October 1970, provided considerable insight into the "end product" of research carried out by this Department on pesticide residues, involving economic and political as well as technical aspects. Valuable personal contacts were made for future reference.

All tolerance recommendations passed through to an advanced stage were in agreement with Australian policy.

Problem areas likely to require close attention by the pesticides staff of this Department were assessed at first hand and some of the information gained has already been applied in investigational work at Rydalmere.

Useful information was obtained from the Japanese Ministry of Agriculture about the working relationship between government and chemical manufacturers, particularly in proving of candidate chemicals.

At the request of the Rice Marketing Board of New South Wales short visits were paid to specialist research institutions and manufacturers in California, U.S.A., and Milan, Italy, to investigate the utilization of rice hulls.

ESTABLISHMENT OF PEST DESTROYERS COMMITTEE

A Pest Destroyers Committee was established. It is comprised of the Director as chairman, the Principal Officer (Pest Destroyers Act), representatives of the Divisions of Plant Industry, Horticulture and Dairying, and representatives of the Biology, Chemistry and Entomology Branches of the Institute. The Committee will aid in the closer scrutiny of pesticide registrations that is now essential. Procedures for registration of pesticides and the Pest Destroyers Act are being reviewed. (

BIOLOGY BRANCH

GENERAL SECTION

Post-Graduate Training

Mr. R. D. Pares, Office-in-Charge, Virology Unit, attended "Micro 70", an international symposium on electron microscopy, at Imperial College, London, and attended a course on the use and maintenance of the Philips EM 300 electron microscope in Holland. He also spent three days at the National Vegetable Research Station, Wellesbourne, Warwickshire to discuss techniques of virology and electron microscopy.

Miss Patricia Broadbent, Plant Pathologist, has been awarded the degree of Master of Science in Agriculture by the University of Sydney. The subject of Miss Broadbent's thesis was "Studies on the Resistance of Citrus to *Phytophthora citrophthora*".

Mr G. M. Murray, Plant Pathologist, has been awarded a post-graduate scholarship by the Australian Wool Board to study for the degree of Doctor of Philosophy at the University of Wisconsin, U.S.A.

Mr. R. N. Allen, Plant Pathologist, has received a New Zealand award from the New Zealand Commonwealth Scholarships and Fellowships Committee. He is studying for the degree of Doctor of Philosophy at the University of Auckland, N.Z.

Mr. P. C. Fahy, Plant Pathologist, attended the Third International Conference on Plant Pathogenic Bacteria at Wageningen, Holland, and visited centres of plant bacteriological research in Great Britain, Europe, the United States of America, New Zealand and the Philippines.

Mr. A. Nikandrow, Plant Pathologist, spent a week at the Plant Quarantine Division of the Commonwealth Department of Health, Canberra, studying the type of work carried out at the Division.

Miss B. J. Ballantyne, Mr A. L. Bertus, Mr J. K. McGechan, Mr R. D. Pares, Mr L. J. Penrose and Mr D. F. Herridge are working on projects for Masters Degrees registered either with the University of Sydney or Macquarie University.

Visitors

Mr. H. Dias, of the Vineland Research Station, Southern Ontario, Canada, discussed aspects of the current research in virology with officers of the Biology Branch.

Dr. D. Gottlieb, University of Illinois, Urbana, a world authority on antifungal antibiotics, and visiting lecturer at the Faculty of Agriculture, University of Sydney, visited the Branch on a number of occasions during the year.

Other visitors included Mr. Khan, Under secretary of Agriculture for Thailand; Professor F. J. Newhook, University of Auckland, New Zealand; Dr. K. Spurgeon, University of North Dakota, U.S.A.; Mr S. S. Ooi, Quarantine Officer, Malaysia; Dr R. H. Fulton, of Rohn & Haas, U.S.A.; Mr Gupta, India; Mr Ldungu, Kenya; Mrs Smithson, U.S.D.A., Oregon; Dr W. Cooper, Orlando Tropical Fruit Research Station, Florida; Mr. Veeraraghavan, Colombo Plan Fellow, India; Mr. A. Newcomb, a nurseryman of Thermal, California; Dr. P. Brook, DSIR Auckland, New Zealand; Dr. P. Minges, Cornell University, U.S.A.; Mr. Diamante, member of a Scientific Advisory Group to the Philippines Government; Dr. Tate, Uniroyal Co., Canada.

A number of plant pathologists from other states also visited the Branch.

Conferences and Schools

Technical conference for the Australian Wine Industry. — Mr J. K. McGechan, Plant Pathologist, attended this conference organized by the Australian Wine Research Institute at Mildura, in July 1970.

Soybean Research Workshop. — Messrs. G. E. Stovold and K. J. Moore, Plant Pathologists, and D.F. Herridge, Bacteriologist, attended this workshop at the University of Sydney in July 1970. The work carried out on soybean mosaic by Mr. Moore was reviewed.

Australian Plant Nutrition Conference. — Dr R. J. Roughley, Senior Research Scientist, and Mr G. E. Stovold, Plant Pathologist, attended this conference at Mt. Gambier in September 1970. Dr. Roughley presented a paper on the survival of *Rhizobia* on pelleted tropical legume seed.

Symposium on Non-specific Resistance to Wheat Rust. — Miss B. J. Ballantyne and Mr K. J. Moore, Plant Pathologists, attended this symposium at the University of Sydney in November 1970.

Biological Control of Skeleton Weed. — Dr P. F. Kable, Special Plant Pathologist, attended a meeting organized by the Chief, Division of Entomology, CSIRO, to discuss the introduction of fungi for the biological control of skeleton weed. A recommendation was agreed to that the rust pathogen *Puccinia chondrillina* be introduced. The pathogen was not considered to be a hazard to any other plant.

Seventh International Conference on Plant Growth Substances. — Dr H. D. R. Malcolm, Plant Pathologist, attended this conference in Canberra in December 1970, and presented a paper "Some Growth Substances Associated with Bud Failure in Peach".

Viticultural Symposium, Griffith. — Mr. J. K. McGeachan, Plant Pathologist, attended this symposium organized by the Royal Agricultural Society in conjunction with the Department of Agriculture and the Irrigation Research and Extension Committee at Griffith in February 1971, and spoke on virus diseases and disease control.

First Australian Seeds Research Conference. — Messrs. A. L. Bertus and A. Nikandrow, Plant Pathologists, attended this conference at Mount Gambier in March 1971. Mr. Bertus presented a paper "Heat Treatment of Seed with Aerated Steam".

27th Annual Conference of the Australian Nurserymen's Association. — Miss P. Broadbent attended the above conference in Hobart in March 1971, and gave an address on the control of fungal root pathogens in nursery soil by biological antagonism.

Conference on Bunt in Wheat. — The Chief Biologist called a conference on bunt in wheat at Rydalmere in March. Representatives from Queensland, Victoria, South Australia and N.S.W. discussed the need for alternatives to the mercury and hexachlorobenzene seed dusts which it was agreed must be phased out of use. Uniform trials to be carried out in three states were planned, to provide information on observed differences in bunt control by dithiocarbamate dusts.

International Training Course on Crop Protection. — A number of officers of the Biology Branch gave lectures and demonstrations for this course.

12th Annual Meeting of the Australian Society of Plant Physiologists. — Dr H. D. R. Malcolm attended this meeting in Brisbane in May 1971, and presented a paper (in co-authorship with Mr P. C. Fahy, Plant Pathologist) "Treatment of Abnormal Growth of Lettuce caused by a Gibberellin-producing Strain of *Fusarium oxysporum*".

Canadian Apple Mission. — Dr. L. R. Fraser, Chief Biologist, represented the N.S.W. Department of Agriculture in Melbourne and Canberra in June at a Conference with a Canadian apple mission and the Federal Department of Health. The mission visited Australia to present a case for relaxation of the existing quarantine ban on the import of Canadian apples. Import restrictions are currently in force because of the presence in Canada of the bacterial disease, fire blight.

International Dairy Federation and XVIII International Dairy Congress. — Dr Richards attended the International Dairy Federation meetings in Melbourne in October 1970 — he was Vice-President of Commission E — Analytical Techniques and Laboratory Methods. Dr Richards, Mrs Colquhoun and Mr O'Toole attended the XVIII International Dairy Congress in Sydney.

Dairy Technology and Education. — Dr. Richards attended Federal Council meetings of the Australian Society of Dairy Technology, as Federal President; meetings of the Standards Association of Australia as the Department's representative on S.A.A. Committee DS/3 - Microbiological Standards for the Examination of Dairy Products; and the Science Subject Advisory Committee for the Food Science Board of Studies designing new curricula for Hawkesbury Agricultural College (as Chairman). He was appointed to the project advisory panel for the dairy research group at Hawkesbury College and the advisory committee for the new Biological and Medical Laboratory Technicians certificate courses at Sydney Technical College. Officers of the Section attended the Dairy Factory Managers and Secretaries Annual Conference. Mrs. Colquhoun has continued as State Editor for the Australian Journal of Dairy Technology.

The Commonwealth and States Veterinary Committee Working Party on Dyemarkers in Antibiotics on which Dr. Richards and Mrs. Colquhoun served at various times, completed its deliberations. A report was prepared on the use of dyemarkers for antibiotics and it was endorsed by Agricultural Council.

Interstate Quarantine

Restrictions on movement into New South Wales of stone fruits from areas of Victoria where *Sclerotinia laxa* occurs, were continued. Regulations concerning the entry into New South Wales of nursery trees of possible hosts of *S. laxa* from Victorian nurseries are being further redrafted as a result of discussions with a deputation of Victorian nurserymen and officers of the New South Wales Department of Agriculture. Previous regulations included requirements for the removal of all dead wood and all wood which had borne flowers from nursery stock and for dipping of all the above-ground parts in the fungicide benomyl. It has now been decided that a very thorough drenching spray of benomyl applied, under the supervision of officers of the Victorian Department, to all nursery trees heeled in a despatch area will be substituted for dipping in the 1971/72 season. This change was made because of problems in ensuring that dipping was carried out effectively. It will be subject to review.

During the early spring of 1970, a number of consignments of potatoes, chiefly from south eastern Queensland were affected with powdery scab (*Spongospora subterranea*). This disease had been recorded in a few localities in New South Wales up till 1933 and had not been seen since that time, nor in 1970, in New South Wales. Regulatory action was taken to prevent the possible establishment of powdery scab, which may have resulted from the distribution of infected tubers from interstate, in areas of New South Wales where the disease had not been recorded or where the pathogen may have ceased to exist.

Restrictions were continued on movement into New South Wales of lucerne hay from areas of Victoria where bacterial wilt has been recorded.

PLANT PATHOLOGY SECTION

Cereal Diseases

Wheat Diseases

Leaf Blight (*Septoria tritici*). — was the most important disease of wheat in New South Wales this season. Usually it is of minor importance and found only on the lower leaves of plants. During 1970/71, leaf spot occurred on all leaves, including the flag leaf, and even on stems and glumes in crops in the southern districts and in eastern parts of the central districts. Yield losses were difficult to estimate but many crops in these districts yielded much less than expected and leaf blight is believed to have been responsible. All varieties were susceptible to leaf blight although Olympic and Pinnacle showed some tolerance.

Glume blotch (*Septoria nodorum*). — causes substantial losses in yield of wheat at irregular intervals in New South Wales. It was important in central districts during 1970/71, causing yield losses of about five per cent. In some areas, 80 to 90 per cent of crops were infected with glume blotch but often farmers were unaware that the disease was present.

Eyespot lodging (*Cercospora herpotrichoides*). — rarely causes losses in yields of wheat in New South Wales. This season, however, it occurred widely from Wagga Wagga, south to the Victorian border. In the Wagga district, overall loss was estimated at 10 per cent, reaching 50 per cent in some areas.

Maize Diseases

Leaf blight (*Trichometasphaeria turcica* = *Helminthosporium turcicum*). — was the most important disease of maize this season. Leaf blight occurs each year but is generally of only minor importance. The unusually wet conditions in the past season were particularly favourable for its development and many crops in coastal districts were severely infected. Consequently, yields were lower than average. The susceptible sweet corn varieties, Iochief and Rosella 425, were heavily attacked and some crops were completely lost. Even the resistant varieties GH 128 and Fitzroy were moderately infected. Leaf blight was so bad in the Windsor district this season that spraying, which is usually not economical, was recommended.

Effect of fungicides on germination and vigour of maize. — Two inbred lines of maize were treated with the fungicides panogen, cerasan and thiram, either alone or in various combinations. Panogen vapour was applied at the rate of 0.1 ml per 40 seeds in a volume of 30 ml and the other fungicides applied to excess in powder form, Thiram, alone or in combination, reduced the germination of seeds and vigour of seedlings of both lines in sterile and unsterile soil. Panogen and cerasan did not reduce germination or vigour.

A suggested new treatment for quarantine maize seed. — The prescribed panogen treatment for boil smut (*Ustilago maydis*) control was reviewed following the change in regulations by the Commonwealth Department of Health which permits an increase in the number of seeds of any line

of maize that may be imported into Australia from 40 to 1000. Teleutospores of *Spacelotheca reiliana*, the common maize smut in Australia, were used for the testing of alternative treatments. Soaking of seed dusted with *S. reiliana* spores in a solution of five per cent sodium hypochlorite for 15 minutes inhibited the germination of all spores. Untreated spores germinated after about two days.

An experiment involving different concentrations of sodium hypochlorite and times of soaking of seed showed that seed germination decreased by about 25 per cent after soaking seed in 12 per cent sodium hypochlorite for 30 minutes. No reduction in germination occurred of seed soaked in 5 per cent sodium hypochlorite for 15 minutes.

The techniques tested in these experiments are being used in work aimed at eradicating maize smut from imported maize seed and the mode of action of sodium hypochlorite on smut spots is being examined.

Take-all Disease of Cereals

Pathogenicity tests have shown that isolates of the take-all fungus (*Gaeumannomyces graminis*) are capable of colonizing and fruiting on cereals and grasses other than those from which they were isolated. This work forms part of a study of fungi found on roots and sheaths of grasses, either as dark hyphae or fruiting bodies, and is fundamental in the elucidation of their life cycles, both saprophytic and parasitic, and the relationships between them.

Cereal Seed Treatments

Hexachlorbenzene (HCB) and organic mercurial seed treatments are widely used to control bunt of wheat, loose and covered smut of oats, and covered smut of barley. The improper use of treated grain has been causing important residue problems in both locally consumed and exported grain and meat products. A concerted effort is being made to find acceptable substitutes for these fungicides. This is proving difficult because substitutes must be as effective in controlling disease as HCB and the organic mercurials, be cheap to use, and yet cause no residue problems.

Diseases of Fodder and Pasture Plants

Lucerne Diseases

Stem nematode (*Ditylenchus dipsaci*). — Lucerne stands on the Belabula River flats where infestations of stem nematode had been found previously were surveyed. Most stands inspected were moderately to severely affected and productivity and longevity were much reduced in many cases. A trial to assess the performance of several lucerne varieties under conditions favourable to stem nematode infection was sown at Canowindra in co-operation with the District Agronomist at Orange. Seed of possibly resistant varieties was made available by CSIRO, Deniliquin.

Clover Diseases

Subterranean clover re-establishment problem. — Continuing an investigation started in 1969/70 of the effect of root rot on subclover re-establishment, a further survey of pastures of the southern tablelands was completed during August. Some recovery from the stunted condition which is common during autumn and winter was occurring, especially in warmer districts.

Examination of further plants in the laboratory confirmed that feeder root damage is constantly associated with above-ground symptoms of stunting and discoloration. The most common fungus isolated from affected roots has been *Pythium irregulare* which has constituted up to 80 per cent of the fungi isolated. Other species of *Pythium* also commonly isolated have been *P. mamillatum*, *P. rostratum*, *P. acanthicum* and a number of sterile *Pythium* species.

When tested in aseptic conditions, these isolates of *Pythium* caused discoloration and stunting of roots of subclover. Experiments to study pathogenicity of the various isolates under different environmental regimes are in progress.

Scorch of subterranean clover (*Kabatiella caulivora*). — A severe outbreak of this disease occurred on the southern tablelands during the spring. Many areas closed up for seed production were severely affected. Laboratory experiments with seed harvested from diseased pastures showed that the level of seedborne infection was less than one per cent and was of no cause for concern. The fungus persists in plant residues and is widely distributed in N.S.W., but is only of consequence in particularly wet seasons.

Cowpea Diseases

Stem rot (*Phytophthora vignas*). — Trials have been commenced to determine the varietal reaction of cowpeas to stem rot, a disease which causes economic losses in this crop in areas of the north coast in most years.

Grass Diseases

Kikuyu yellows disease (cause undetermined).— effect of the form of nitrogen in fertilizer applications to yellows-affected kikuyu pasture was investigated. Although different treatments brought about a temporary recovery in growth in affected areas of kikuyu, no treatment exerted a long-term ameliorating effect on the disease. Also, the method of cultivation did not appear to affect disease severity.

The new kikuyu variety Whittet was found to be susceptible to yellows disease in glasshouse tests.

Work on this disease has been suspended during the absence overseas of the plant pathologist from Wollongbar Agricultural Research Station.

Diseases of Oil Seed Crops

Safflower root rot (*Phytophthora dreschleri*). — Root rot was only of minor importance in safflower crops this year, losses of yield from root rot infection being negligible in most districts. The drier than average spring conditions were unfavourable to infection.

Glasshouse experiments showed that *Phytophthora dreschleri* could infect and kill safflower plants of any age. *Pythium myriotylum* was also capable of killing older plants but the other *Pythium* spp. associated with root rot were only pathogenic in the seedling stage. *P. dreschleri* was also pathogenic to mature saffron thistle plants.

Blackleg of rape (*Leptosphaeria maculans*).— Blackleg is a potentially serious disease of rape and several severe infections were recorded during the year. The pathogen survives very successfully on crop debris so that a reasonable rotation should be followed. The disease is also seed-borne and several seed treatment methods are being investigated.

Withertop of rape. — occurred in most crops in the central and southern part of the state. The disease is a physiological disorder thought to be caused by a deficiency of calcium experienced during rapid growth stages of the plant. The excessive rainfall around flowering is thought to have made soil calcium unavailable to the plants.

Soybean mosaic virus. — was positively identified in several crops of soybeans this season. Because of its low incidence (less than one per cent in most crops) it did not cause any reduction in yield in commercial crops. Seed crops at University Farm, Camden, were very severely affected and seed was therefore diverted for processing. Infection was spread by a heavy aphid population from sources originating from infected seed. Work is in progress to determine effect of inoculation with virus at different stages of plant maturity on productivity and on seed transmission.

Diseases of Vegetables Crops

Potato Diseases

Potato seed certification.— Records compiled by the Division of Plant Industry show that, on the northern tablelands, no crops were rejected from certification because of excess content of virus or other diseases for which certification tolerances have been set. Only traces of virus leaf roll and purple-top wilt were present in these crops. Blackleg was more active than usual due to prolonged periods of wet weather but was kept below certification tolerance by roguing.

In the Orange district of the central tablelands, two crops comprising 13 acres were withdrawn from certification because of excess blackleg content and one crop of three-eighths of an acre was withdrawn because of excess content of blackleg and virus leafroll. In the Crookwell section of the central tablelands one crop of 1½ acres was rejected from certification because of excess leafroll content. Blackleg was present in some crops in the Crookwell area but was below certification tolerance.

Powdery scab (*Spongospora subterranea*) was recorded on tubers produced at Ebor on the northern tablelands in June 1971. This disease has not been recorded from Ebor since 1927 nor in any area of New South Wales since 1933. The Chief Quarantine Officer (Plants) for New South Wales has taken quarantine action to prevent the spread of the disease from the property concerned.

Rugose mosaic (Potato Virus X and Potato Virus Y). — No advanced Departmental seedlings were submitted for testing during 1970/71 for field reaction to infection by Potato Virus Y.

Bacterial wilt (*Pseudomonas solanacearum*). — This disease was reported from the Ebor-Hernani and Meldrum areas of the north coast. At Meldrum an area of some 150 acres was involved.

Asparagus Diseases

Decline and replant problem, Gundagai.— A further comparison was made of the yield of marketable spears from the block of the fusarium-tolerant selection planted in old asparagus ground in 1963 with the yield of comparable plantings of the susceptible 500W strain. Both were harvested in the late spring and early summer of 1970. The yields obtained were 500W strain, 2711 lb/acre, fusarium-tolerant selection 3607 lb/acre.

Crucifer Diseases

Club root (*Plasmodiophora brassicae*). — Co-operative work with the Bathurst District Agronomist continued on the Macquarie River flats at Bathurst where club root is a serious and wide spread disease. The transplant-site soil drench (3/4 pint fungicide suspension/transplant site) was used to compare the fungicides captafol, dithane C90 and benomyl with the recommended quintozone soil drench. No significant differences in yield or severity of root clubbing were recorded between the control and any of the fungicide treatments.

Sclerotinia rot (*Sclerotinia sclerotiorum*). — Sclerotia of this fungus can germinate in the soil to produce apothecia or mycelium. Studies of the factors affecting production of apothecia and mycelial growth continued. The effects of different concentrations of oxygen, carbon dioxide and of inverse ratios of oxygen and carbon dioxide, on mycelial growth and apothecial production were studied using a gas diffusion column. Variation of oxygen level did not affect mycelial growth until the concentration fell below two per cent, after which growth quickly ceased. Increasing concentrations of carbon dioxide reduced growth in an approximately linear relationship with a 50 per cent reduction at 21 per cent carbon dioxide. Inverse ratios of oxygen and carbon dioxide also produced an approximately linear relationship between mycelial growth and increasing carbon dioxide-decreasing oxygen concentrations; at 10 per cent carbon dioxide — 11 per cent oxygen, growth was reduced by 50 per cent and at 21 per cent carbon dioxide — 0.16 per cent oxygen, growth was inhibited. Production of apothecial initials was more sensitive to oxygen concentrations than was mycelial growth. No initials were produced below two per cent concentration. Above two per cent the numbers increased with oxygen concentrations to 10 per cent then remained constant as oxygen concentration increased.

Field trials for control of sclerotinia rot in crops of seed cauliflowers and tomatoes were carried out, at Castle Hill (Sydney metropolitan area) and Cudgen (north coast). In the cauliflower trial only 12.5 per cent of the control plants were diseased at flowering. All infections originated on the aerial parts of the plants. Foliar sprays of benomyl again reduced infection; the 16 oz/100 gal rate applied at two week intervals reduced infection to three per cent. In the tomato trial at Cudgen 45 per cent of control plants were infected at the end of the trial. All except a few infections were at ground level. The currently recommended fungicide, dichloran, reduced plant loss (infection) to 28 per cent, while benomyl reduced plant loss to three per cent.

Disease of Beans and Peas

Bean seed certification scheme. — No crops were certified in the 1970–71 season.

Summer death of beans. — Increased use of summer death-resistant varieties has further reduced losses from this disease.

Introduction and field testing of varieties, to determine their reaction to summer death, has continued. Of 202 lines grown at Yanco Agricultural Research Station, 56 were susceptible and 146 had resistance. As in previous years the field tests included many curly top resistant varieties and advanced breeding lines from the U.S.A., several European varieties, a wide range of dry bean varieties and numerous new varieties introduced by seedsmen and processors from overseas.

Several of the summer death resistant varieties continue to perform well agronomically and are being used for commercial production. Processors and seedsmen have maintained close interest in this work.

Disease-free seed of several summer death resistant lines introduced from overseas has been distributed.

Rust of French bean (*Uromyces appendiculatus*). — Rust can be a troublesome disease, particularly in coastal areas of the state. Some varieties, particularly of the dry bean type, are very susceptible.

One hundred and thirty-one of the lines included in the summer death trial at Yanco were exposed to a natural outbreak of rust in a replicated trial at Rydalmere in the autumn of 1970. Six lines were immune and three were highly resistant. These included several navy and Great Northern

types which are generally severely affected by rust. One Great Northern variety introduced from the U.S.A. appeared to be segregating for resistance with an occasional highly resistant plant among severely affected plants.

The susceptible lines varied in severity of rust attack. Seventy-six lines, mostly green bean types, were only slightly rusted and could be grown in all areas of New South Wales with a minimum of risk of loss from rust. This group also contained three wax beans, red kidney types and Borlotto.

Clover stunt of french bean (Subterranean Clover stunt virus).— This disease has caused losses of up to 40 per cent in local bean crops grown for processing. Varietal reaction of 136 lines to clover stunt was tested at Rydalmere. The incidence of the disease was insufficient for definite indications of resistance. However, there were some tendencies in resistance to guide future investigation of possible combined resistance to curly top in U.S.A. and summer death and clover stunt in Australia.

Virus diseases of peas. The aphid-transmitted virus disease top yellows is troublesome in most seasons in the central tablelands and during some seasons in other areas. Field testing of pea varieties for resistance have been reported previously. A trial at the Agricultural Research Station, Orange, in 1970 was inconclusive because plants were severely damaged by weather.

Mushroom Diseases

Virus diseases. — A survey of the virus disease of the cultivated mushroom, *Agaricus bisporus*, during the early part of 1970/71 showed that crops in the general area of Blacktown were severely affected. A strict routine of plant sanitation and the availability of virus-free spawn has resulted in a general decline in virus disease in farms in other areas.

A type of virus particle, not previously recorded as associated with the disease in Australia, was detected by electron microscope examination of abnormal mushrooms. Several samples of diseased mushrooms contained spherical particles 50 nanometres (nm) in diameter. The number of different types of virus particles found in cultivated mushrooms in Australia now stands at five: 19 nm, 25 nm, 29 nm and 50 nm spheres and 19 x 50 nm bacilliform particles.

A high proportion of apparently healthy mushrooms was found to carry viruses. There were a few crops of mushrooms in which no virus particles were detected although they showed symptoms resembling virus infection.

Bacterial disease (*Pseudomonas tolaasii*). — Brown blotch disease was common in many farms particularly in the autumn months of 1971. Losses were heavy in a few cases. Preliminary studies have indicated that biological control of bacterial blotch is worthy of further investigation as some bacterial isolates obtained from soil and peat moss have shown biological antagonism when tested against *Ps. tolaasii* in the laboratory.

Hexachlorophene, normally used in the form of a dust to control brown blotch, gave a much better control when dissolved in alcohol and used as a spray on infected beds.

Mushroom compost mixtures. — The composition of fermenting mixtures of mushroom compost in use at several farms in N.S.W. was studied with a view to formulating a balanced mixture. Thirty-six different formulae were tried at one farm. Formulae for improved compost mixtures, resulting from the trial doubled the production of mushrooms on this farm.

The effect of supplementation of compost, at spawning, with cotton seed meal and cotton seed oil was also studied. Results were inconsistent. This work is being continued.

Citrus Diseases

Phytophthora Root and Collar Rots

Rough lemon introductions. — During the year the resistance to root rot (*Phytophthora citrophthora*) of four rough lemon selections from Florida, eight from California and three from India compared with New South Wales selections of rough lemon was assessed in three trials. Most of the overseas introductions and a few New South Wales selections were red rough lemons, which are reported to have better resistance to root rot than the commonly used rough lemon stock. Four overseas introductions (Milam, 58-329-502, 58-328-503 and 57-278-502) showed better resistance to root rot than New South Wales selections. Three of these will be used as rootstocks in a lemon rootstock trial to be propagated for planting at Somersby in Spring, 1971.

Trifoliolate hybrids. — Resistance to root rot (*Phytophthora citrophthora*) of 31 scarlet mandarin x *Poncirus trifoliata* and three Cleopatra mandarin x *P. trifoliata* hybrids bred at the Horticultural Research Station, Narara, was compared with rough lemon and *Poncirus trifoliata*. All hybrids were more susceptible to root rot than *Poncirus trifoliata* but three hybrids had good resistance and four moderate resistance to root rot and are worthy of trial as rootstocks.

Virus Diseases of Citrus

Greening disease. — Application of soil drenches of tetracycline (1000 ppm every three days for two months) to plants severely affected by suspected greening failed to alleviate symptoms. Electron microscope studies have shown structures similar in appearance to mycoplasmas, in indicator plants, but as yet the nature of these structures has not been clearly defined.

Indexing of Departmental mother trees. — Psorosis — no trees were indexed last year. Xyloporosis — indexing continued in collaboration with the Division of Horticulture; no new trees showed symptoms.

Grapefruit stem pitting. — Observations on field trials in collaboration with the Division of Horticulture continued. Mild strain propagation, challenged with aphid-purified severe strains of stem pitting introduced in citrus tissue, have developed severe stem pitting symptoms. Severity of symptoms has varied with the severity of the stem pitting strain used.

Exocortis. — The dwarfing bud-lines used in horticultural trials in New South Wales were indexed for psorosis, xyloporosis and exocortis. No symptoms of psorosis, or xyloporosis were produced on indicator plants by any of these. Exocortis symptoms were produced on Etrog citron indicator plants but phloem ray cells of trifoliolate bark did not produce the colour reaction when stained with phloroglucinol-hydrochloric acid which is claimed to be a characteristic of exocortis. The results suggest that exocortis virus exists in a number of strains, varying in the degree of stunting caused and in the amount of scaling, with some strains of exocortis causing no scaling, and no phloem symptoms sufficient to give a reaction to biochemical stains for gums.

† *Chemical control of citrus black spot* (*Guignardia citricarpa*). Experiments were continued at Mangrove Mountain and Narara to control black spot of citrus without causing deleterious effects to fruit quality and yield.

At Mangrove Mountain, very light crops were produced because of unfavourable climatic conditions and no worthwhile assessment of black spot incidence was obtained. The fungicide captafol applied at 2 lb/100 gallons water at petal fall gave good control of melanose. However, following an application of scalcidol oil nine weeks after petal fall, severe rind blemish developed on immature fruit that had received this treatment. Captafol must therefore be excluded from any citrus spraying programme because of the likelihood of interaction with white oil producing severe rind blemish.

At Narara, five applications of benomyl at 8 oz/100 gallons gave good control of black spot. This was particularly noticeable in old Valencia trees where 95 per cent spot-free fruit was produced. Similar trees receiving a standard Bordeaux mixture — zineb programme produced only 77 per cent clean fruit. When applied to mature fruit benomyl appeared to reduce the amount of black spot developing in fruit on trees which had been rejuvenated by "skeleton" pruning. This suggests that established latent infections were either killed or rendered incapable of progressing to the formation of lesions.

Melanose (*Diaporthe citri*). — A randomized block trial comparing nine treatments for the control of melanose infections on Washington navel orange fruits was conducted at Narara. Dormant sprays of lime sulphur (7/100) wettable sulphur (4/100) and captafol (3/100) applied in August and followed at Petal-fall with applications of Bordeaux mixture 6-6-100-½ showed no advantage over a single Bordeaux application at petal-fall, with an average of 12.5 per cent severely affected fruit. Applications of Bordeaux mixture 4-4-100-¼ were made at various intervals from petal-fall to 9 weeks later. Best results were obtained with Bordeaux mixture applied at petal-fall and repeated six weeks later, with 5.2 per cent melanose in the severe grade. Untreated fruit had an average of 20.7 per cent in the severe grade.

Citrus nutrition research. — The nutrition trial, commenced in 1964 at the Horticultural Research Station, Narara, was continued in collaboration with the Chemistry Branch and the Division of Horticulture. Data from four crops was collated and submitted for analysis. Visually, the outstanding features at this stage were the effects of rate of nitrogen on tree condition and the development of magnesium deficiency symptoms where low magnesium application was combined with high rate of nitrogen use. Generally imbalance between rates of nitrogen and bases caused deterioration in tree health.

Diseases of Pome Fruit

Apple Scab (*Venturia inaequalis*). — Apple scab was again troublesome in tableland districts. Spraying with benomyl after harvest and before leaf fall was very promising for control by eradicating the overwintering stage of the pathogen. This treatment will be an alternative to mercury compounds now used.

Apple fruit rot (*Phlyctaena vagabunda*). — Studies of this fungus, which is responsible for fruit rots on the tablelands and south western slopes, revealed that it overwinters in dead pruning snags and cankers.

A related fungus, *Pezicula malicorticis*, was isolated from cankers in trees at Orange and Batlow, and from rotted fruit beneath cankered trees at Orange, the first record of its occurrence in New South Wales. In some overseas countries *P. malicorticis* is regarded as an important post-harvest fruit rot. Its significance in New South Wales is not yet known.

Powdery mildew (*Podosphaera leucotricha*).— This disease is difficult to control wherever apples are grown. Fungicides for its control were tested in co-operation with the Division of Horticulture at Bathurst Agricultural Research Station, and oxythioquinox seemed to give best control of the disease. Data is being analyzed.

Zinc deficiency. — Trials with zinc compounds on apples were continued at Neurea in co-operation with the Chemistry Branch and the Division of Horticulture. Zinc Sulphate, zinc oxide and zinc chelate were applied at several rates and times of year. So far control of zinc deficiency has not been obtained even with application rates as high as 50 lb zinc sulphate per 100 gallons.

Internal bark necrosis (Measles). — This widespread condition results in a general lack in tree vigour. Soil conditions and budwood sources are being examined as possible causes. Early results from glasshouse experiments indicated that soils to which manganese has been added, and soil from measles areas of low pH, may induce measles in commercial apple clones.

Virus diseases. — Identification of virus diseases of pome fruit in New South Wales continued. Apple rubbery wood was detected in apples for the first time in New South Wales as was apple chlorotic leafspot virus in pears and apples. These latent viruses are thought to reduce tree vigour and fruit yields.

Bitter rot (*Glomerella cingulata*) is an important disease in coastal districts. Work commenced to find an economical and efficient control measure.

Sooty blotch (*Gloeodes pomigena*). — The efficiency of post-harvest dips in treatment of this disease is being investigated.

Diseases of Stone Fruit

For control of brown rot (*Sclerotinia fructicola*). — New fungicides were tested on peaches and prunes. Benomyl remained the best available fungicide. Results showed that spray timing was very important. Protective spraying throughout the flowering period is essential for satisfactory control of the disease in prunes in the Young district.

Benomyl was registered in New South Wales for use on fruit crops in December 1970, and was used extensively thereafter. Some excellent results in brown rot control were obtained. Incorrect timing of sprays and unsatisfactory application methods appeared to have been involved in the few cases reported of poor control.

Brown rot forecasting. — A brown rot forecasting service for the Murrumbidgee Irrigation Areas commenced and operated successfully during the peach harvest period (February and March). Co-operators were the Bureau of Meteorology and the local television station from which forecasts were issued each evening.

The service contributed to improve disease control in early February when the weather pattern was particularly favourable to brown rot development and heavy losses would normally be expected. The weather was successfully forecast, and it is believed that most farmers took preventive action. Some farmers did sustain serious losses, but the overall loss was slight.

Peach virus complex — *M.I.A.*— During the past three years 329 selected trees of canning peach varieties have been indexed for the presence of virus. Dark green sunken mottle virus was found in 20 per cent of the trees examined and of these 50 per cent were also infected with *Prunus* necrotic ringspot (PNRV). Virus was found in both healthy and unthrifty trees.

Officers of the Biology Branch visited Victoria to examine the peach rosette disease in the Goulburn Valley and to have discussions with Victorian plant pathologists. The disease position in Victoria has been clarified considerably and the respective roles of dark green sunken mottle, *Prunus* necrotic ringspot and prune dwarf viruses defined.

It now seems clear that rosette disease, as now defined, is not present in New South Wales. The most important virus in the rosette complex is prune dwarf, either alone or in combination with *Prunus* necrotic ringspot or dark green sunken mottle viruses. Prune dwarf virus was not detected in any of the peach trees indexed by a variety of methods in New South Wales. This appears to explain the lack of the typical rosette disease seen in Victoria.

Another condition, the symptoms of which are bare laterals resulting from the abscission of lateral buds, exists in peaches in both New South Wales and Victoria. The cause of this abscission, which can occur during winter and up till blossoming, is unknown. In some varieties relatively few trees are affected but in others all trees exhibit these symptoms even after heat treatment to eliminate known viruses. Two field trials were commenced at Yanco Agricultural College and Research Station to determine if transmissible agents are involved.

Peach replant problems. — Recent reports from the United States of America suggested that Pythiaceus fungi may be involved in some forms of the peach replant problem. So far the suggestion has not been supported by examination of soils from the Murrumbidgee Irrigation Areas.

Bacterial canker. — Evaluation of several chemical treatments of soil and planting material for control of bacterial canker was commenced on the Murrumbidgee Irrigation Areas following reports from California that some soil fumigants were effective against the disease.

Armillaria root rot on peach. — The fungus *Armillaria mellea* was first found in the Murrumbidgee Irrigation Areas in 1969, in a peach orchard near Leeton. It was recorded for the second time, again on peach, near Griffith in 1970. Measures aimed at eradicating the fungus were taken in both areas, infected trees and roots were removed and burned and the ground is to be kept fallow for at least three years. The outbreak near Leeton appeared to have originated from a single, introduced nursery tree. Spread of the disease was examined with the aid of aerial photographs taken at regular intervals for the tree census. This study yielded valuable information on the rate of spread of *A. mellea* in this environment.

Stone fruit rust (Tranzschelia discolor). — The air dispersal of uredospores of this fungus was investigated. Computer models were developed which predict spore dispersal from a knowledge of prevailing weather conditions. The importance of this disease has increased over the past few years, probably as a result of changing fungicide usage.

Apricot decline (suspected virus). — Indexing work, to elucidate the cause of this condition affecting many apricot trees in the Kurrajong district, continued. Symptoms of the disease are yellowing of leaves followed by collapse of the tree which often occurs after rain. Gum discovered in the xylem vessels of the trunks of diseased trees could be expected to interfere with water uptake and therefore be involved in the subsequent collapse. The disease has not yet been reproduced and no virus has yet been isolated on indicators.

Prune dieback. — Investigation began of the problem of prune decline and dieback on the Murrumbidgee Irrigation Areas. Possible contributing factors may be root rotting fungi, bark injury and premature defoliation due to rust or other causes.

Diseases of Grapevines

Downy mildew (Plasmopara viticola). — Exceptionally wet conditions in coastal districts during December and January resulted in severe outbreaks of downy mildew, particularly in vineyards inadequately protected by fungicidal sprays. As in previous trials dithianon gave the best control of the disease under conditions favourable for its development. Good results were obtained with copper oxychloride-zineb and mancozeb. Several areas in the Pokolbin district were sprayed throughout the season exclusively by helicopter. The control obtained equalled the best from ground application and it is probable that helicopters will be used far more extensively in the future. Testing of chemicals for control of downy mildew have been concluded.

A trial has begun to assess the long-term effects of some of the more commonly used fungicides — Bordeaux mixture, dithianon, copper oxychloride-zineb and ziram. Any differences are unlikely to be apparent at least for three seasons.

Virus diseases. — Indexing of varieties and clones of grape-vines recently imported from Europe was commenced. There were early indications that many of the superior European clones are virus-infected. The two viruses detected are leafroll and grapevine fleck virus, a virus which is

Australia is present in a number of phylloxera-resistant rootstocks. Indexing of vines in the Division of Horticulture's clonal selection programmes also commenced. Many, if not all, of the selected clones of Gordo Blanco are infected by leafroll virus. Results for other varieties are not yet available.

Diseases of Tropical Fruits

Banana Diseases

Leaf spot and speckle (*Mycosphaerella* spp.). — Weather on the north coast during the infection season was generally favourable for heavy infection by leaf spot and speckle diseases. The weather sometimes made it difficult to apply the recommended control programmes, but control, particularly of leaf spot disease, was generally satisfactory where the programme was adhered to as closely as possible. Aerial spraying was again reported to give less control of leaf speckle than of leaf spot. Good underleaf coverage is necessary for adequate control of leaf speckle. In one area of the north coast aerial spraying with benomyl plus oil gave fairly good control of leaf spot, but again, poor control of leaf speckle.

Market diseases (*Nigrospora sphaerica*, *Colletotrichum musae*). — As a result of the experiments reported last year an agricultural formulation of the fungicide thiabendazole has been registered in New South Wales for the control of blackend and squinter diseases caused by *N. sphaerica*. The fungicide is used as a post-harvest dip at 200 ppm. Some control of wound infections caused by the anthracnose fungus *C. musae* will also be obtained with thiabendazole at this rate.

Passionfruit Diseases

Fusarium wilt. — Breeding for resistance to *Fusarium* wilt (*Fusarium oxysporum* f. *passiflorae*) continued at the Horticultural Research Station, Narara. Of 360 self-pollinated vines established a number were culled as too closely resembling the flavicarpa parent. Three unsuccessful attempts were made to establish cuttings from the remaining vines to test their resistance to *F. oxysporum* f. *passiflorae* in the greenhouse. High incidence of the virus disease bullet in these vines caused the failure. Open-pollinated seedlings of most vines were obtained in October 1970, and these were inoculated with *F. oxysporum* f. *passiflorae* in the greenhouse. Resistance varied considerably and 20 of the most resistant vines were chosen for further self-pollination.

Vine condition in the field has deteriorated due to bullet. Selfed seed, however, has now been obtained from six of the most promising vines. This seed will be germinated for spring planting.

Brown spot of passion vine (*Alternaria passiflorae*). — Fungicidal treatments were assessed at the Horticultural Research Station, Somersby. Spray applications were made monthly. Incidence of brown spot in control plots averaged 80.5 per cent. A number of vines were killed out by brown spot lesions on canes. Best control was obtained with mezineb (1 lb/100) resulting in an incidence of only 7.5 per cent brown spot on the fruit. Other treatments were: trimanzone (2 lb/100), 11.6 per cent; Bordeaux mixture 5-5-100, 12.1 per cent; daconil (2 lb/100), 12.3 per cent; dithianon (2 lb/100), 12.6 per cent; maneb (2 lb/100), 16.8 per cent; and ferban (2 lb/100), 19.6 per cent brown spot on the fruit.

Diseases of Ornamentals

Azalea petal blight (*Ovulinia azalae*) was again severe. Testing of fungicides for its control continued. The systemic fungicide benomyl sprayed fortnightly at the rate of 4 oz a.i./ 100 gal of water or weekly at half this strength during the spring flowering period controlled the disease. The grey mould fungus *Botrytis cinerea*, sometimes also associated with petal blight, was not controlled by this fungicide.

Root rot (*Phytophthora cinnamomi*) remains one of the most important soil-borne diseases of ornamental plants. Chemical treatment of soil with dexton, captan and Cheshunt compound provided some temporary control.

Downy mildew of rose (*Peronospora sparsa*) was recorded for the first time in Australia in a commercial planting in the Sydney metropolitan area. In some varieties this disease causes severe defoliation and damage to flower buds and flowers.

Carnation rust (*Uromyces dianthi*) was severe in some commercial crops during summer. Oxycarboxin drenches or zineb sprays failed to provide adequate control.

Powdery mildews were severe during spring and early summer on roses and other ornamental plants.

Frost damage was severe in spring, in parts of the metropolitan area, central coast and west of the ranges.

Aerated steam treatment of seed. — In studies of the effects of aerated steam on seed and seed-borne diseases *Pleospora papaveracea* infection of poppy seed was eliminated by treatment at 54.4°C for 10 minutes with some loss in germination ability.

Studies of aerated steam treatment have included effects on total germination, rate of germination and the leaching of substances such as sugars, amino acids and other electrolytes from seed as a result of heat injury. Generally dried seed has been better able to withstand heat than moist seed. Moisture content of seed is determined mainly by the relative humidity of the atmosphere in which it is stored; it was found that all seed was similar in absorption of water. There appeared to be no relationship between the initial moisture content of seed or the treatment temperature, and the moisture content after treatment, but the amount of water absorbed during a treatment was much less than during a comparable hot water treatment. Varietal differences in heat tolerance have been investigated. Seed of 37 varieties of lettuce was compared in investigation of differences between varieties in heat tolerance. There was great variation; mortality of treated seed ranged from 0 to 80 per cent. Brown-seeded varieties were generally more heat tolerant.

Temperature of seed during treatment was measured by implanting specially made thermocouples inside the seed. The surface of the seed reached the treatment temperature immediately. The temperature at the centre of the seed took two to four minutes to equalize with the surface temperature then rose to about 1°C more than the surface temperature. This was maintained for periods as long as 115 minutes of treatment. If the seed coat was ruptured, the internal temperature dropped to the level of that at the surface. There was no obvious difference due to varying moisture contents of the seed. Hot water treatment gave similar results. Seed killed by exposure to formalin vapour or fixed in formalin acetic acid also showed a similar effect.

PLANT PHYSIOLOGY

Physiological effects attributed to plant pathogens have been observed, mainly in vegetable and fruit crops. Several reports linking growth substances produced by plant pathogens with the onset of disease are being examined. Abnormal growth of lettuce in commercial crops at Wagga has been found to be due to gibberellin released by *Fusarium oxysporum* and two promising chemical means for its control are being assessed. Other investigations include: treatment of broiler litter to remove the hormone causing abnormal growth of vegetable and flower crops; residues of herbicides in vegetable and fruit crops and soils; split-corm of bananas; and determination of the structure and synthesis of the active growth substances associated with bud failure of stonefruits.

BIOLOGICAL CONTROL OF PLANT PATHOGENIC FUNGI

Microbial Antagonism to Phytophthora spp. — The suppression under field conditions of *Phytophthora* in two avocado soils is being studied. Despite continuous rain, favourable temperatures and the presence of *P. cinnamomi* no trees declined. Raw unfiltered avocado soil extract from these groves caused lysis of mycelium and almost completely inhibited sporangial formation. Sporangia which were formed were readily broken down by bacteria. The pathogen is not eliminated through bacterial action but it appears to be held in check. Sporangia nearing maturity exert a chemotactic effect on certain bacteria in the avocado soil extract. Bacterial rods accumulate at right angles to the sporangial wall and appear to penetrate the cell wall. This possibility is to be studied by electron micrographs.

Biological control of fungal sclerotia. — A relatively simple and inexpensive method has been developed for eliminating fungal sclerotia from soil by biological means. It is based on drying the sclerotia sufficiently in soil in the absence of host plants. When remoistened either by rain or irrigation the sclerotia leak large quantities of nutrients, which stimulate other micro-organisms which then parasitize the sclerotia and rot them within about two weeks.

PLANT QUARANTINE

Quarantine crops in the Plant Quarantine Station, Rydalmere, and at centres in the country and in the metropolitan area were inspected and examined.

Quarantine crops to be planted outside the Quarantine Station, Rydalmere, were treated in the prescribed manner, sent to the appropriate quarantine centre and inspected twice during the growing season. There were 325 lines in 64 inspections.

Crops in the Plant Quarantine Station were examined daily and the number of lines examined was 1,153. In both cases detailed examination of any diseased specimens was made. A total of twenty-seven diseased specimens from Export and Import Branch were examined.

Use of tissue culture for eradication of plant viruses. — Growth of meristems of quarantine potatoes in artificial culture was attempted in conjunction with heat therapy to free them of virus. Meristems, with several leaf primordia attached, produced roots and shoots on a modified Murashige and Skoog medium but contamination with micro-organisms continued to be a problem.

NEW RECORDS OF PLANT DISEASES

Over fifty new records of plant diseases were made in New South Wales during the year. On safflower, several species of *Pythium* were isolated from rotted roots. New grass hosts for downy mildew (*Phytophthora macrospora* (Sacc.) Ito & Tanaka) and anthracnose (*Colletotrichum graminicola* (Ces.) Wilson) were found.

A blotch disease of mushrooms was found to be caused by the bacterium *Pseudomonas tolaasii*. On ornamental plants, a severe seedling blight of Iceland poppies in a commercial nursery was caused by *Pleospora papaveracea* (deNot.) Sacc. and a species of *Guignardia* was associated with leaf spots in several different orchids. Several other diseases of native plants and weeds were recorded.

CHECK LIST OF PLANT DISEASES IN NEW SOUTH WALES

The main work on the check list in 1970/71 was with diseases of cereals and grasses. The fungi causing cereal take-all were investigated in detail and their identities clarified. Several other root and stem attacking fungi of cereals and grass were examined and descriptions of two previously undescribed species prepared. The smut fungi on ryegrasses in New South Wales have been identified, and work has continued on the ergots and ergot-like fungi on pasture grasses. Many overseas herbaria have lent type and other specimens.

THE BIOLOGY BRANCH HERBARIUM (DAR)

Over 1,500 specimens were added to the Herbarium, bringing the total to nearly 26,000. Specimens were received from the University of Queensland, and from Victoria, Tasmania and the Northern Territory, but the bulk of collections made were from New South Wales.

In June 1970, permission was granted by the Public Service Board to implement the computer recall and indexing system prepared for the Biology Branch Herbarium. A punch paper tape machine has been installed in the herbarium and two operators trained. Several hundred records of specimens are already on tape, test programmes for these tapes are almost completed and initial test print-outs have been obtained. Indexing of the herbarium is expected to take two to three years.

Many plant parasitic fungi were identified for inquirers. Edible and poisonous fungi were identified and information on hallucinogenic species supplied to the Police Department.

NEMATOLOGY

Nematode collection and taxonomy. — Sixty-nine additions were made to the collection of plant parasitic nematodes. The collection now has 664 accessions representing 77 different plant parasitic species.

A new monodelphic species of *Xiphinema* was described and the host range, multiplication rate and length of the life cycle of this nematode studied. New morphological data on *X. radicicola* and *S.monohysterum*, monodelphic species closely related to *X. australiae*, was obtained and a key to monodelphic *Xiphinema* prepared. The male of *X. monohysterum*, which had not been seen previously, was described.

Root knot nematodes (*Meloidogyne* spp.). — Investigation of seasonal changes in *Meloidogyne* species outdoors at Rydalmere entered its third winter. A clear picture of the stages of the life cycle present at different times of the year is emerging and will assist in cultural and chemical control.

In recent years certain non-volatile, water dispersable compounds have shown promise as nematocides. These are easier to apply than conventional fumigant nematocides and have less exacting temperature, moisture and soil tilth requirements. The carbamate, aldicarb, gave good control of root knot nematodes on tomato in laboratory and field tests. Two other experimental nematocides, methomyl and thiabendazole had some effect in laboratory tests but were not effective under field conditions. Detailed studies are in progress on the effectiveness of non-volatile chemicals against the three species of *Meloidogyne* important in New South Wales.

Cereal cyst nematode (*Heterodera avenae*). — Surveys since the initial discovery of *H. avenae* in New South Wales have indicated that it is confined to a small number of farms near the Murray River at Koraleigh. As control is difficult, action under the provisions of the Plant Diseases Act was recommended to guard against possible spread. These measurements would restrict movements of soil, rooted plants or contaminated farm machinery from infected farms.

Several different races of *H. avenae* are recognized on the basis of host plant preferences. It is therefore necessary to know which race is present before rotation crops are selected or breeding for resistance is attempted. Work on this aspect is not yet complete, but it appears that the race present in New South Wales is the same as the race present in Victoria.

Xiphinema spp.— Studies on *Xiphinema americanum*, a species complex which, in New South Wales, includes at least three species, were continued. The complex includes species which are known to be vectors of plant virus diseases elsewhere. The confused state of the identification of species prevents determination of which species are virus vectors.

Populations of *X. americanum* group species from New South Wales proved difficult to culture under pot conditions even on hosts which are usually good hosts to *Xiphinema* spp. Field sampling for the past two years has shown that, under N.S.W. conditions, members of this group may have no special breeding season.

Other current studies on *Xiphinema* species include the seasonal occurrence of *X. australiae* under natural forest conditions and the transmission of virus diseases by *X. australiae* and *X. monohysterum*.

ELECTRON MICROSCOPY-VIROLOGY

Installation of major items of equipment has been completed. All are performing satisfactorily.

Specialist services of the unit are now organized and meeting increased demand. Services were provided for: Quarantine; the Veterinary Research Station, Glenfield; Biology Branch; Chemistry Branch; and Entomology Branch. They resulted in large savings of time and benefited research projects.

Major research included: ultrastructure of virus-infected citrus leaves; ultrastructure of *Phytophthora* sporangia attacked by bacteria; ultrastructure of fungal sclerotia; the relationship between virus particle types seen in the electron microscope and infectivity; and the ultrastructure of plant tissue infected with lettuce mosaic virus. Three of these projects were in co-operation with other officers of Biology Branch.

BACTERIOLOGY SECTION

Dairy Bacteriology

Starter Cultures

Supply of starter cultures for cheese, yoghurt and other cultured milk products to the New South Wales dairy industry continued. The total of 2,618 starter cultures supplied was 357 more than in 1969-70. Enquiries for cultures to make yoghurt and cheese at home increased.

Butter Quality

Biological analyses of manufactured bulk butter consigned from country factories to the Central Grading Floor at Sydney, Granville, Blacktown and Newcastle, were carried out during the main producing months from September 1970 to April 1971. A total of 579 samples were analysed for five different microbiological counts. Results and brief comments on possible sources of contamination and recommendations for improvement were sent to the District Dairy Officers and factory managers. Quality was lower than in the previous year; a particularly bad season and outbreaks of ephemeral fever could have been contributing factors.

A survey of the quality of retail print butter in country areas involved 67 samples. Samples purchased by District Dairy Officers were sent to the butter graders of the Division of Dairying for organoleptic evaluation and to this section for microbiological analysis. Fewer samples were satisfactory on all counts than in the previous year. This type of survey is designed to assist processors, distributors and retailers of butter to maintain butter quality until the product reaches the consumer.

There were several surveys of butter processing plants. Samples for microbiological analysis were taken from each stage of the processing and, as far as possible, one sample was followed through each mechanical operation. Results indicated possible improvements in cleaning and sanitizing of equipment and in the hygiene of factory personnel.

Biological Cheese Quality

Bacteriological analyses of cheese produced in New South Wales continued. Cheese samples taken from each factory once a month were analysed for coliform and staphylococcal contamination. Cheese quality has remained around the same level as in 1969-70, but staphylococci decreased and coliforms increased.

Antibiotics in Dairy Produce

This programme, commenced in 1967, continued. One additional antibiotic was tested in excretion trials in conjunction with Glenfield Veterinary Research Station.

Mastitis Control Programme

The mastitis control programme, conducted jointly by the Divisions of Dairying, Animal Industry, Marketing and Economics, the Biometrical Branch, and the Biological and Chemical Research Institute, began in January, 1969. This section is responsible for the bacteriological analysis of milk samples from selected herds in the central coast and the subsequent testing of bacterial isolates against the antibiotics recommended for use in the programme. During the two months base period, where all quarters in each herd were bacteriologically examined twice, 3,364 samples were analysed of which 28.7 per cent showed growth of mastitis pathogens. During the control period that followed, three-monthly samples of quarters were again analysed. After 12 months of the control period, 14.9 per cent showed growth of mastitis pathogens, and at the end of 24 months the figure was 17.6 per cent.

Other aspects of the mastitis control programme are reported by the Divisions of Animal Industry and Dairying.

Electronic Cell Counting Using the Coulter Counter

Work to establish a reliable method of electronic counting of somatic cells in milk using the Coulter Counter proceeded, with milk samples received for the mastitis control programme.

A chemical method of dispersing fat globules is being used. Cells can be counted only if all particulate matter of approximately their size is broken down to smaller dimensions or removed completely. In milk, the main particulate matter is fat globules. In the chemical method the white blood cells present in the milk are fixed and the milk is treated with a strong surface active agent at raised temperatures to break down fat globules. The globules are then small enough not to interfere with the counting of the leucocytes.

Cell counts have been made on a large number of these milk samples, and compared with direct microscopic counting using the Breed smear. Counts will be continued on milk from the mastitis control programme to obtain a correlation between the electronic cell count and the direct microscopic count. The aim is establishment of a routine procedure for the rapid analysis of milk for leucocytes. It is hoped, by further work on the Coulter Counter, to extend its operation to include the counting of bacterial micro-colonies for the biological analysis of dairy and other products.

This is the only laboratory conducting this type of work with the Coulter Counter in Australia. The Western Australian Department of Agriculture has sought advice on the method.

Wollongbar Laboratory

A bacteriologist commenced duty at the new laboratory at the Agricultural Research Station, Wollongbar, after in-service training at Rydalmere.

A one-gramme scoop and a cork-boring method were compared as sampling methods for butter in a preliminary survey. Counts were lower with the cork-boring method. The incidence of coagulase-positive staphylococci and their role in the development of flavour defects in farm cream were surveyed in 78 samples of farm cream delivered to one factory. Coagulase-positive staphylococci did not appear to be associated with any specific flavour defect.

Other Services

Biological defects in food products were investigated. Samples analysed included yoghurt, goats milk, continental cheeses, and flavourings.

Soil Bacteriology

*Inauguration of Australian Inoculants Research and Control Service (A.I.R.C.S.)** — From 1956 the Biology Branch and the Faculty of Agriculture, University of Sydney, jointly operated the University-Department of Agriculture Laboratory Service (U-DALS) to control the quality of commercial legume inoculants. However financial support for the future was uncertain. This year the Australian Agricultural Council agreed to provision of continuing finance, subject to the relocation of the service at Rydalmere. The new service is called the Australian Inoculants Research and Control Service.

Financial assistance for the research programme has been received from the inoculant manufacturers, the Australian Wool Research Trust Fund, Australian Meat Research Committee, Wheat Industry Research Council and the Australian Dairy Produce Board. The Commonwealth Department of Primary Industry and the Rural Credits Fund of the Reserve Bank of Australia contributed to the cost of laboratories for the unit completed in January 1971.

Quality control of commercial peat inoculants. — Since January 25, 1971, 121 of 133 *Rhizobium* broths submitted by manufacturers were found to be satisfactory. The hosts were: clover 64; medic 26; pea 11; bean 1; lupin 25; lotus 2; lotononis 2; leucaena 1; and desmodium 1. Of 106 freshly-manufactured and resubmitted batches of peat cultures tested, 65 passed as satisfactory.

Country peat survey.— Of 397 peat legume inoculants bought in New South Wales country stores 86 per cent were satisfactory compared with 89 per cent of those tested in the previous year.

Testing of the first samples of peat inoculants bought in stores in Western Australia and South Australia was completed. The results in Western Australia were; clover - 8 tested, 2 satisfactory; medic - 2 tested, both satisfactory; lupin - 4 tested, all satisfactory. Results in South Australia were: clover - 7 tested, 3 satisfactory; medic - 6 tested, all satisfactory; pea - 1 tested and satisfactory; lupin - 1 tested and satisfactory; and lotus - 1 tested and satisfactory.

Soybean - Rhizobium effectiveness trial. — Four strains of *Rhizobium* were tested on five varieties of soybean in strain trials on soybeans at the University of Sydney farm at Camden and at the Narrabri Agricultural Research Station. The strain used in commercial inoculants for soybean, CB1809, was the most satisfactory on Lee, Bragg, Hampton and Ogden and strain CC709 the best on Hardee.

ENTOMOLOGY BRANCH

GENERAL

Overseas Tour - Chief Entomologist

The Chief Entomologist attended the Ninth Commonwealth Entomological Conference, the Commonwealth Agricultural Bureaux Review Conference and an International Study Conference on Current and Future Problems of Acridology in London during July, 1970. These Conferences were attended by representatives from many countries of the world and much information of direct value to Australian entomology was gleaned.

He discussed present trends and future prospects in the control of insects in the U.S.A., Canada, England, the Netherlands, Denmark, West Germany, Switzerland, Italy, Ethiopia, Kenya and South Africa. In a number of institutions visited opportunity was taken to inspect various research techniques and laboratory architecture.

Special attention was paid to new insecticides and new approaches of pest control, insecticide resistance, hazards in and environmental contamination by the use of pesticides, injurious effects of pesticides on wildlife, integrated pest control concepts and disinfestation of fruits for internal and export markets. The organisation of locust control campaigns in the Middle East and Africa was examined as was the Argentine ant problem in the U.S.A. and South Africa.

Regulatory procedures in the registration of pesticides were investigated in the U.S.A., Canada, England, the Netherlands, Denmark, Italy and South Africa.

Since returning in September 1970, the Chief Entomologist has organised a survey of insecticide usage in N.S.W. and initiated ecological investigations of insect pest complexes as a first step in integrated pest control. The objective is to use all suitable techniques in a compatible manner to reduce pest populations and maintain them at levels below those causing economic injury. However, pesticides will continue to have to play a preponderant part in pest control for the foreseeable future.

Safe and Effective Use of Insecticides

The Entomology Branch Bulletin S62 "Insecticides — How to Use Them Safely and Effectively", which states policy and provides guidelines for use of insecticides in N.S.W., was revised and reprinted in its third edition early in 1971.

This comprehensive publication, is the only one of its kind in Australia and one of the very few in the world. The Commonwealth Department of Labour and National Service has requested approval to incorporate it in the Department's Rural Safety series. Favourable comments have also been made by wildlife and other environmental authorities and members of the general public.

International Training Course in Crop Protection

An International Training Course in Crop Protection was organized by a committee, of which the Chief Entomologist was a member, under the auspices of the Department of Foreign Affairs. The Course was sponsored by the Australian Government under the Colombo Plan, the Special Commonwealth African Assistance Scheme and the South Pacific Aid Programme. It was attended by some 25 officers, mostly government officers, who were experienced in matters associated with crop protection in African, Asian and Pacific countries.

An officer of the Entomology Branch co-ordinated the contributions of this Department to the programme for the course and he and other officers provided lectures and demonstrations. Subjects emphasised were: integrated pest control; safe and effective use of insecticides; and pests of cotton and tropical fruits.



Protection for both the users of agricultural chemicals and the consumers of agricultural produce continued to be stressed in the Department's advice to farmers. Its bulletin on safe use of insecticides has been in heavy demand since the first edition in 1964. Chemists monitor residue levels in a wide range of foods.

PASTURE AND FIELD CROP PESTS

Australian Plague Locust, *Chortoicetes terminifera*. Activity of the first locust generation in spring, 1970, was mainly concentrated in the Cobar and Bourke districts. At Bourke hatchings were followed by formation of some bands and widespread loose to scattered populations. Lack of rain caused considerable mortality of early hatchings. In the Cobar district, where weather was more favourable, many dense, marching bands were present in an area between Cobar and Ivanhoe. Aerial spraying destroyed most of these bands and only an occasional loose swarm of adults developed.

In December, a relatively small infestation occurred in the Jerilderie and Urana-Corowa districts with bands and swarms. They were sprayed by landholders and Pastures Protection Boards. No further reports of swarms were received from this area after January.

In February, extensive swarm activity was reported in the Forbes and Condobolin districts. Surveys indicated broad areas of loosely swarmed locusts, especially in the Forbes district, with very dense cores of ovipositing locusts. There was some movement of swarms into the Molong district but most flight activity was of the "milling" type. The parasite, *Scelio fulgidus*, was found to be common in eggs laid by these swarms.

At the same time dense bands of locusts occurred over wide areas in the Hay and Hillston districts. In March, these produced very large and dense flying swarms in the districts of Condobolin (western end), Hillston, Hay, Narrandera and Deniliquin. Extensive aerial spraying was carried out under the Department's direction during March and April. Egg laying was intense and extensive in all infested districts and widespread outbreak is expected in Spring, 1971. Neighbouring districts of Wagga, Jerilderie, Moulamein and Balranald also had significant increases in locust numbers during autumn so that a broad belt of country in south-western N.S.W. is expected to be active in the coming season.

In the northern part of the State, flood rains during summer gave rise to prolific pasture growth, probably hindering swarm formation from scattered locust populations and making assessment of populations difficult. Loose swarms were reported from the districts of Mudgee, Coonabarabran and Dubbo and also high numbers from Coonamble, Bourke and Moree late in the season.

An aerial spraying experiment, to control locust bands expected to develop in the Cobar district in September/October, was organized in co-operation with the Pastures Protection Section. Detailed ground surveys of the infested area were commenced shortly after hatching and all bands and dense non-swarmed locusts were plotted onto large-scale maps. Aerial spraying was finished just after fledging commenced. A single aircraft was used to deliver 4 fl. oz. of technical fenitrothion per acre to selected blocks of country. A total of 224 bands and 84 sub-bands was sprayed. Some of the bands were very large and more than a mile in length. In addition, many locusts treated were in dense, non-banded populations. Approximately 14,000 acres were sprayed with 333 gallons of technical fenitrothion at a total cost of \$6,650 (48 cents an acre).

The spraying was an outstanding success. Only two small loose swarms of adults were located in the whole district after spraying. The project demonstrated the effectiveness of aerial spraying of an intense infestation of bands in a relatively confined area. Its success depended on preliminary detailed investigations by the Patrol Officer of the parent generation of locusts; and detailed survey of the infested area shortly after hatching and prior to spraying.

In post-spray assessments it was noted that the boom-nozzle system used did not provide perfect droplet coverage of treated areas and results due to contact effect of the insecticide were sometimes patchy when weather conditions and terrain were not ideal for spraying. However, the fenitrothion had enough residual action (up to 10 days) to kill a very high proportion of the locusts eventually. Samples of locusts showing typical symptoms of organic phosphate poisoning were collected from selected sites several days after treatment. When kept in cages with a plentiful food supply many recovered and later laid eggs. However, field observations suggest that locusts similarly affected by lethal doses in the field may have a much lower survival rate under conditions of stress.

The Patrol Officer again provided a great deal of accurate and detailed information on locust movements and behaviour. It was clearly demonstrated that thorough knowledge of locust activity is essential for successful control campaigns and for the reduction of costs during aerial campaigns in particular.

The Patrol Officer carried out one wide ranging aerial survey of far western districts in early summer, in addition to the usual ground surveys by vehicle. The acquisition of a small motor cycle, originally for use during aerial surveys, added a new dimension to survey work. It was used extensively during the Cobar experiment and proved ideal for scouting rough areas. It allowed observations comparable to those made on foot and was far superior to a closed vehicle. Coverage of a great deal more country than on foot was possible and field tests showed that counts of low populations of adults on a transect were equal in accuracy to counts made on foot. In addition early instars, small bands and scattered populations of nymphs were readily located from the motor cycle.

Diapause eggs were studied in detail. It was found that a high percentage of diapause eggs was laid by locusts brought into the laboratory from several locations in central western N.S.W. Production of diapause eggs persisted in the laboratory for three locust generations under constant conditions. Locusts collected from Cobar district did not lay diapause eggs. The occurrence and persistence of diapause in the laboratory from some field stocks, and not others, under constant conditions is of considerable interest as shortening day length in autumn is believed to be the mechanism that triggers diapause in the field.

The parasitic mite, *Podapolipus* sp.— first noted in the laboratory in early 1970 — recurred in April, 1971. A survey of southern N.S.W. showed that its distribution was very widespread. Mite infestation on locusts under laboratory conditions was studied.

The study of locust morphometrics was continued and a number of new locust series was collected. The gregariform status of locusts collected in the Tilpa district April, 1970, was confirmed.

Plotting and mapping of all field information on locust occurrence during the 1969/70 season were completed.

Wingless Grasshopper, Phaulacridium vittatum

Only isolated reports of damaging populations were received. These were from localities in the southern and northern tablelands. Excellent rain during the period November to February was unfavourable for development of the hoppers.

Spur-Throated Locust, Austracris guttulosa

Individual specimens were observed frequently in north western districts late in the season, following flood rains in summer. No damaging populations occurred in N.S.W. although considerable damage to sorghum was reported in Queensland.

Small Plague Grasshopper, Austroicetes cruciata

No serious infestations occurred in N.S.W. during the year. Localized areas of moderately dense hoppers were present in the Narrandera, Hay and Cobar districts in early spring.

During the aerial spraying experiment against plague locusts in the Cobar district in October it was observed that 4 oz technical fenitrothion was highly effective against the resident population of small plague grasshoppers also present.

Black Beetle, Heteronychus arator

In a screening trial on plots of young seedling maize at Rydalmere, six different insecticides were jetted into the soil around the plants to compare protection from black beetle attack and to note any phytotoxic effects associated with their use as soil additives. The insecticides applied were: aprocarb, gardona, methoxychlor, synergized pyrethrins and DDT as dilute emulsions and carbaryl wettable powder in aqueous suspension. The control plots were jetted with water only. Beetle damage in the carbaryl, DDT, methoxychlor and synergized pyrethrins treatment was markedly less severe than in gardona and control treatments; aprocarb had an intermediate effect.

Excessive leaf yellowing developed in many plants treated with synergized pyrethrins but may have resulted from localized waterlogging of the soil for long periods after excessive rain. Phytotoxic effects were not observed in plots which received any of the other five chemical treatments.

In contrast to mercury vapour light, which is highly attractive to black beetle adults, sodium vapour light again proved ineffective in light-trapping investigations in the field.

In recent years black beetle has been much less common as a pest in coastal New South Wales than it was in the 1940's and 1950's. This decline is related to the absence of a series of years in which the rainfall during spring-early summer was markedly deficient. The extreme wetness of December, 1970, which brought record and near-record rainfalls to parts of the coast, is thought to have caused heavy mortality amongst immature stages of the 1971 generation.

Seed-Harvesting Ants

Observations were made at Bathurst Agricultural Research Station in April and May, 1971, the months most favoured for aerial sowing of pasture seed in the central tablelands. In marked contrast to the very numerous *Pheidole* nest-outlets, and the very high rate of seed removal at the Station in autumn 1968, the surface infestations and activity of *Pheidole* in April/May, 1971 were at a very low ebb. This appeared to be a result of the extraordinary abundance of dropped seed from the luxuriant

ground vegetation which followed very high rainfall in February. In observations of the rate of removal of pasture seed by *Pheidole* foragers, 50 seeds of *Phalaris tuberosa* were placed on the ground near each of the six ant foci discovered with more than minimal surface activity. After 5½ hours seed numbers were reduced by 16 to 98 per cent, with a mean of 62.3 per cent.

Field screening tests with chemical seed dressings to reduce or prevent seed removal by *Pheidole* were continued, with special attention to insecticides other than chlorinated hydrocarbons. Indications of a useful degree of deterrence were obtained with thanite, aprocarb and gardona.

Observations in far western districts in August showed many accumulations of floral debris around nest-outlets of *Pheidole* and *Iridomyrmex*. Buffel grass husks were sometimes plentiful around *Pheidole* outlets. Whereas the *Pheidole* ants are true seed-harvesters the *Iridomyrmex* are probably "decorators", with seed-moving habits likely to prejudice seedling establishment. Both types of ants could have an important effect on buffel grass establishment in the northern part of the Western Division and some adjacent districts.

Bloodworms in Rice, Chironomus spp.

The density of bloodworms in natural pools of water near rice bays in the Leeton district was calculated from weekly examinations of 10 sites during August to December. Bloodworm numbers were low until mid-September, following sufficient rain to produce natural pools in August. Numbers increased at most sites during October and November with a pronounced population peak in late November. Numbers then decreased rapidly.

Adult populations were also assessed by light trapping on the bank of a rice bay at Yanco Agricultural College and Research Station. There was a correlation between adults appearing in traps and counts of bloodworms in natural pools.

In aerial spraying trials abate was applied at 2 oz and 4 oz a.i. per acre. In one trial the rice crop had been sown by air into flooded rice bays in which closely grazed herbage had been disturbed by rigid tyne cultivation. In the second trial, the crop had been sod-seeded into closely grazed pasture. Bloodworms were completely controlled by abate at 4 oz in both trials. At 2 oz abate was fully effective against the infestation in aerially sown rice but there was a twenty per cent survival in the sod-seeded crop. Measurements of root growth indicated abate was not phytotoxic. In sowings on three Coleambally district properties, rice seed treated with abate at 2 oz per 100 lb of seed was protected against bloodworms throughout the establishment period. The season's work confirmed that abate is a suitable alternative to DDT against bloodworms.

Lucerne Bud Mite, Aceria medicaginis

Buds of all samples of lucerne from the Armidale, Bathurst, Batlow, Cootamundra, Tumut and Wagga districts during the year were infested with the lucerne bud mite. On no occasion was any "witches' broom" disease symptoms present in the lucerne; nor was any serious damage to the lucerne observed.

Lucerne plants at Rydalmere were found to support substantial numbers of mites throughout the warmer months of the year. No damage to the plants was noted.

Amnemos Weevils, Amnemos spp.

In a series of three laboratory experiments, the incubation period and mortality of *Amnemos quadrituberculatus* eggs were shown to be correlated with incubation temperature and relative humidity. Incubation period increased with decreasing temperature, ranging from 7-9 days at 27.5°C to more than 23 days at 15°C. Mortality increased linearly with temperature from 22.5°C to 30°C with no eggs surviving at 35°C. Of the four relative humidities tested (70, 80, 90 and 100 per cent) 90 per cent was the most favourable to egg development at all temperatures.

Preliminary experiments to determine the effect of soil saturation on mortality of first instar larvae showed that survival decreased with increasing length of the saturation period. Larvae survived up to eight days of saturation. Three soil types, red basalt, chocolate basalt and Kangaroo Creek sandy loam were used and there was some evidence of differences in larval survival between soil types.

A new method for extracting larvae of *A. quadrituberculatus* from soil samples was evaluated in August. The technique was more accurate in extracting larvae from soil than the modified "Salt and Hollick" process used for this work for the past 10 years and as much as twice as fast. In addition, most larvae extracted were undamaged and so could be used for laboratory experiments.

The extremely dry winter in 1970 greatly reduced the number of tropical legume plants in far north coast pastures. Control plots of three field experiments were sampled for larvae in August. One experiment had been commenced in 1967 and the others in late 1969 to examine long-term control of *Amnemos* from pre-sowing treatments with dieldrin at 1 lb per acre and heptachlor at ½ lb, 1 lb and 2 lb per acre. Number of *Amnemos* larvae found in control plots were insufficient for statistical analysis and further sampling was therefore abandoned for the season. The low numbers of larvae were related to the loss of legumes at the old site through drought and to the recent establishment of the new sites where numbers of *Amnemos* had not yet built up.

In two other field experiments, established in 1966 and 1967; the dry weather caused complete disappearance of legumes and sampling was therefore impossible. The treatments being tested are dieldrin at ½ lb, 1 lb, 2lb and 4lb per acre.

Cotton Insects

Severe floods in late January and February destroyed an estimated 90 per cent of the area sown to cotton in the Namoi Valley. Prior to flooding common bollworm, *Heliothis punctigera*, was reported to have been inadequately controlled by aerial applications of DDT during the main squaring, flowering and boll-setting phase of growth. It was considered that aircraft operators may have reduced the volume applied per acre to a level too low for adequate coverage of the young foliage. There was no evidence of DDT resistance in the common bollworm.

Cotton tipworm, *Crocidosema plebiana*, appeared in some flood-free crops during late February and early March. This is unusual and was probably due to the adverse effect of flooding on parasites and/or predators of the cotton tipworm.

Soybean Insects

A survey of insects on soybean crops was made in the Lachlan Valley of central western New South Wales during February and March, 1971. Insects observed were brown ground bug, *Dictyotus caenosus*; lucerne seed web moth, *Etiella behrii*; green vegetable bug, *Nezara viridula*; tobacco looper, *Plusia argentifera*; soybean moth, *Stomopteryx simplexella*; and the grass blue butterfly, *Zizeeria otis labradus*.

Adults of brown ground bugs were present in every crop inspected. Whilst many soybean growers considered that the bugs affected pod set, seed yield and seed quality by feeding on the flowers and pods, field observations indicated that the bugs were of minor concern as they fed infrequently and were also deterred from feeding by the hairs on the soybean pod.

Caterpillars of lucerne seed web moth were feeding on developing soybean seeds in crop. Although this insect has not caused much economic loss, the widespread practice of sowing soybeans in close proximity to other legume seed crops which flower earlier, particularly lucerne, may increase the incidence of damage through migration of moths into soybean crops.

All stages of green vegetable bug were observed in several crops. Increased numbers of these bugs have similarly occurred in previous high-rainfall years in inland areas.

Sunflower Insects.

Infestations of rutherghlen bug, *Nysius vinitor*, breeding in flowering and maturing sunflower seed heads occurred in the north, central and south western New South Wales during summer and autumn. Early sown crops were most susceptible with reductions in seed yield ranging from 10 to 40 per cent.

Budworms, *Heliothis* spp., were also present in many crops in the same areas. Larvae fed mainly on the fleshy parts of sunflower heads rather than on the seeds.

The brown ground bug, *Dictyotus caenosus*, a native insect, was also common in sunflower crops. Some injury was reported in crops where clusters of bugs fed on stems and caused developing heads to wilt.

Rape Seed Insects

During spring, heavy infestations of the grey cabbage aphid, *Brevicoryne brassicae*, turnip aphid, *Lipaphis pseudobrassicae*, and green peach apid, *Myzuz persicae*, occurred on flowering rape seed crops in the north, central and south west of the State.

Growers were advised not to carry out control measures unless there was definite evidence of aphid injury. Many heavy infestations were controlled naturally by biological agencies. Where chemicals were used, effective control was obtained by using 4 oz demeton-S-methyl per acre.

In situations where damage did occur it was limited to a degree of pod distortion as a result of feeding injury by the aphids.

Noctuid Caterpillars

Techniques to breed large cultures of caterpillars of several economic Noctuids on an artificial lima bean-based diet were further advanced. Cultures of the following species were established: bogong moth, *Agrotis infusa*; black cutworm, *A. ipsilon*; northern budworm, *Heliothis punctigera*; green looper, *Plusia chalcites*; common armyworm, *Pseudaletia convecta*; and cluster caterpillar, *Spodoptera litura*.

The effects of inbreeding and different rearing and handling methods on the resulting vigour of cultures of each species were observed. It was found that all caterpillars of these species could be bulk reared using plastic petri dishes and ice-cream containers. Disease and cannibalism were not significant problems with this procedure. However, whilst cluster caterpillar was maintained continuously for 14 generations it was not possible to culture bogong moth, northern budworm, green looper, and common armyworm without the periodic introduction of fresh moths.

An aberrant mating effect, in which pairs failed to separate following copulation, was observed in cultures of northern budworm, common armyworm and cluster caterpillar, but was only of significance in the northern budworm culture.

Topical application of one microlitre doses of technical grade insecticides to various caterpillars indicated that: 0.1 per cent DDT, carbaryl, fenthion and trichlorphon were ineffective against third instar larvae of black cutworm; 0.1 per cent DDT and trichlorphon were toxic to third instar larvae of common armyworm but ineffective against fifth instar larvae of the same species (dose rates lower than 0.1 per cent were ineffective); and 4.0 per cent DDT was not lethal to fifth instar larvae of black cutworm and cluster caterpillar.

FRUIT TREES PESTS

Two-Spotted Mite, Tetranychus urticae

Work on the soil application of a systemic acaricide for the control of two-spotted mite continued with application of aldicarb at 0.2 oz per inch of trunk diameter to the soil underneath the canopy of six large peach trees at Yanco Agricultural College and Research Station in December, 1970. The insecticide was immediately taken into the soil by irrigation water. This treatment protected the trees from harmful mite infestation for the whole season. Foliage remained green and there was no premature leaf drop. Neighbouring untreated trees were heavily mite-infested from January until April and had a large amount of premature leaf drop in late summer.

One of the main problems in controlling two-spotted mite in deciduous fruit trees is obtaining adequate coverage and penetration of the interiors of the trees with automatic spraying machines. Long-term studies to seek ways to improve the effectiveness of automatic spraying equipment were started in a co-operative project between the Divisions of Horticulture and Research Stations, and the Chemistry Branch at Orange. Four manufacturers of orchard sprayers provided machines which were adjusted and operated by them in accordance with specifications. The performance of commercial machines is being compared with thorough hand spraying.

A means of avoiding contamination between strains was developed in preparation for the screening of acaricides against two-spotted mite. French beans were used as food-potted plants were held in isolation cages of transparent P.V.C. sheet formed into a cylinder, sealed at one end with a double layer of fine muslin and embedded in a sand-filled tray.

Integrated Control of Apple Pests

Investigations were continued in a block of 159 Granny Smith and Jonathan apple trees at Bathurst Agricultural Research Station. These trees have not been treated with commercial pesticide schedules since the 1965/66 season.

In 1969/70 it was shown that when broad-spectrum insecticides were not applied in summer, then one spraying with DDT applied in the flowering period (to control plague thrips, *Thrips imaginis* and apple dimpling bug, *Campylomma livida*) and with winter oil in the dormant period (to control San Jose scale, *Quadraspidiotus perniciosus*) may not seriously affect the biological control of three important apple pests. These pests were: two-spotted mite, *Tetranychus urticae*, woolly apple aphid, *Eriosoma lanigerum* and light-brown apple moth, *Epiphyas postvittana*. However, a programme of two DDT sprays — one at pink, the other at full bloom — considerably depressed populations of predatory mites.

This year the aim was to test the effect of applying DDT and dormant oil in successive seasons. The treatments were: Plot A — first season, dormant oil and second season DDT at pink and full bloom; B — DDT at pink and full bloom in both seasons; C — DDT at full bloom in both seasons; D — DDT at pink in the first season and no treatment in the second; and E — no treatment in the first season and dormant oil at pink and full bloom in the second season. All five plots were sprayed with ryania for control of codling moth, *Cydia pomonella*, and captan and dinocap for control of fungus diseases.

In plots A, B and E high populations of two-spotted mite developed during late summer. On the other hand, mite populations remained very low throughout the season in Plot D (untreated) and low in plot C (DDT at full bloom). Two-spotted mite build-up was probably due to the destruction of predatory mites by the treatments A, B and E. These mites were plentiful in the untreated plot. Regular spray schedules, such as used in plots A, B and E, may result in harmful infestation of two-spotted mite.

There was a sharp increase in infestation by European red mite, *Panonychus ulmi*, a pest which has gradually become more prominent since commercial spray schedules ceased. The pest approached an economic level in the plot sprayed twice with DDT in successive years (plot B). It was also noticeable, but much less abundant, in the plot sprayed once with DDT in successive seasons (plot C). Few mites were present in plots sprayed with winter oil in 1969 (plot A) and 1970 (plot E) and in the unsprayed plot (plot D).

Populations of two-spotted mite and European red mite were rapidly reduced by ladybirds, *Stethorus* spp., principally *S. vagans*, in February and March.

Although parasitism of woolly apple aphid by the wasp, *Aphelinus mali*, was high in all plots in 1970/1 an economic level of infestation by this aphid was present in about 12 per cent of trees in the experimental block. In a commercial orchard the degree of infestation would have required the application of an insecticide. None of the insecticidal treatments A to D had an adverse effect on the seasonal activity of the wasp. This season's results indicated that, even when enabled to operate freely, this parasite is not always able to check the aphid sufficiently.

Infestation of fruit and foliage by light brown apple moth was no greater in the four treated plots than in the untreated plot. In Jonathans four per cent of fruits were damaged compared with 1.5 per cent in Granny Smiths. The greater susceptibility of the Jonathan variety to fruit damage has been noted for five seasons during which broad spectrum summer sprays have been withheld.

An average of 6.4 per cent of fruit was infested by San Jose scale on trees which had not been sprayed for the control of this pest since the winter of 1966. In contrast, trees sprayed with dormant oil in the winter of 1969 showed 0.34 per cent infested fruit and those sprayed with oil in the winter of 1970 had 0.06 per cent infested fruit.

While no gross symptoms of injury have appeared on trees not sprayed for scale control for five seasons there is sufficient scale to indicate that such symptoms may appear in 1971/72. The work suggests that it may be necessary to treat for San Jose scale every third season in the Bathurst district.

The incidence of apple looper caterpillar, *Chloroclystis* sp. was low (less than 0.5 per cent) in all plots 1970/71. This pest has damaged as much as 5 per cent of fruit in previous seasons.

Despite 11 applications of ryania on Granny Smiths and 9 applications on Jonathans, control of codling moth was unsatisfactory.

Plague Thrips, Thrips imaginis

Development of alternative materials to DDT for control of plague thrips and apple dimpling bug, *Campylomma livida*, is being investigated as part of a co-operative research programme on apple pests in which the Departments of Agriculture in Victoria, South Australia, Tasmania and New South Wales and the Division of Entomology, CSIRO, are collaborating.

In a trial on Granny Smith apples at Bathurst Agricultural Research Station seven other insecticides were compared with DDT. The treatments were: TDE 0.1 per cent; endosulphan 0.66 per cent; methoxychlor 0.2 per cent; chlorcam 0.15 per cent; phosalone 0.06 per cent; maldison 0.06 per cent; gardona 0.1 per cent; and DDT 0.1 per cent. All treatments were applied as emulsifiable concentrates at full bloom in mid October. These treatments were also tested for control of plague thrips on *Pyracantha* sp. at the Station in December.

Plague thrips populations were low in both trials. DDT gave very good results in both trials, TDE gave promising results (in the apple trial it was superior to DDT and to all other treatments) and methoxychlor was also promising although inferior to DDT and TDE in both trials. Endosulphan

and chlocram were inferior in both trials while phosalone was much inferior in both trials. Maldison was moderately effective in both trials. Results with gardona were inconsistent — it performed very well in the apple trial but was much inferior in the *Pyracantha* trial.

Apple dimpling bug was in such low numbers during the apple trial that no indication of the efficacy of the various treatments could be obtained.

Codling Moth, Cydia pomonella

The possibility of reducing the number of spray applications by treating only when codling moth was taken in a light trap was tested at Bathurst Agricultural Research Station. Infestation by codling moth and light-brown apple moth was compared: (a) in a 2½ acre block of apples sprayed six times at regular three-weekly intervals with azinphos-methyl 0.05 per cent; and (b) in an adjacent 1½ acres of apples sprayed with 0.05 per cent azinphos-Methyl only when codling moth appeared in a 4-watt ultra violet light trap hung in the tree canopy.

The incidence of moths in the trap was such that it was possible only to reduce the number of sprays from six to five. In some cases, however, a spray was applied when one or two moths were trapped. A higher level of catch may be permissible before a treatment is required.

Excellent control of both codling moth and light-brown apple moth was obtained in both blocks. No deep entries by codling moth were recorded, while only one per cent of fruit in each block was damaged by light-brown apple moth.

Apple Malformation

The relationship between apple dimpling bug populations at blossoming and the extent of fruit malformation in Granny Smith apples was studied at Bathurst Agricultural Research Station. Populations were low — there was an average of five bugs per 100 blossom clusters through the blossom and petal fall period; this increased to nine bugs per 100 clusters some 14 days after petal fall.

Despite the low populations, fruit damage at harvest was relatively high: 11.6 per cent of fruits were malformed; 4.4 per cent were sufficiently damaged to require downgrading. This compared with 4.7 per cent of fruits malformed and 0.3 per cent downgraded in 1969/70, a season in which bug numbers were somewhat higher.

Survey of Pome Pests

The survey of insects and mites on apple trees was continued, observations being made at Armidale, Batlow and Bathurst. Unsprayed young trees and neglected trees were mostly examined.

A particular search was made for mites. About 20 species belonging to the following families were found: Phytoseiidae, Bdellidae, Tarsonemidae, Tetranychidae, Eriophyidae, Phytotritpalpidae Tyroglyphidae and Tydeidae.

The European red mite was found for the first time at both Armidale and Batlow. Three species of phytoseiid mites were taken on non-bearing trees at Bathurst. Two-spotted mite was present only on commercially sprayed trees on which it was the sole mite species.

Fruit Tree Borer, Cryptophasa unipunctata

A survey was made of 11 prune and cherry orchards at Young in August to ascertain the incidence of fruit tree borer. Of 622 prune trees inspected at random, 58.2 per cent were infested. Of 453 cherry trees similarly examined 54.5 per cent were infested. Although a high proportion of both prune and cherry trees were infested trunk damage was much more prevalent in cherries than in prunes. Limb damage was more marked in prunes than in cherries.

Oriental Fruit Moth, Cydia molesta

Flight activity by adults of oriental fruit moth was monitored by means of syrup-terpinyl acetate lures in a peach orchard at Leeton as a basis for spray warnings to peach growers in the Murrumbidgee Irrigation Areas. The orchard was sprayed twice, in November and January, with azinphos-methyl 0.05 per cent. The highest daily catch during the season was 5.6 moths per trap on 30th November, 1970, the peak of the first summer generation.

Green Peach Aphid, Myzus persicae

The following treatments were tested against green peach aphid on young peach trees at Yanco Agricultural College and Research Station: pirimicarb 0.02 per cent, bayer 8527 0.03 per cent and demeton-S-methyl 0.03 per cent. All material gave almost 100 per cent mortality of green peach aphid within 24 hours. No re-infestation occurred for 20 days during which adjacent unsprayed trees remained heavily infested.

A colony of green peach aphid was started as a reference strain. It was used to establish susceptible response lines from which LC50 values were derived for a number of chemicals. Adult aphids were topically treated. LC50's were: phosphamidon 0.001 per cent, demeton-S-methyl 0.0015 per cent, methidathion 0.0018 per cent, omethoate 0.0021 per cent, dimethoate 0.0022 per cent, mevinphos 0.0024 per cent, methomyl 0.0035 per cent and dursban 0.0048 per cent.

Citrus Red Scale, Aonidiella aurantii

In the Murrumbidgee Irrigation Areas, red scale infestations were lighter than in recent years, although problems persisted in orchards where control measures were not applied adequately. In these orchards there was substantial fruit blemishing, especially of Valencia oranges in summer-autumn.

In lower Murray orchards, where both red scale and yellow scale, *Aonidiella citrina*, occur, infestations were usually not troublesome.

Sprays applied in February, 1970 to Valencia orange trees in the M.I.A. were assessed in winter, 1970 and at fruit harvest in January, 1971. Under generally mild infestation conditions promecarb 0.06 per cent plus white oil 1/100 and omethoate at 0.05 per cent plus white oil 1/100 and at 0.03 per cent plus white oil 1/100 gave satisfactory scale control, similar to that obtained with recommended sprays dimethoate 0.03 per cent plus white oil 1/100 and ethion 0.075 per cent-in-oil 1.25 per cent.

The effects of red scale control sprays on a wasp parasite, *Comperiella bifasciat* of red scale and on other beneficial insects, especially scale-eating ladybirds, were evaluated in an M.I.A. trial. Treatments were single sprays of dimethoate 0.03 per cent plus white oil 1/100, maldison 0.1 per cent plus white oil 1/100, ethion 0.075 per cent-in-oil 1.25 per cent and white oil 1/50 in February, 1970 on Valencia orange trees. Assessments were made on samples of scale-infested fruits before spraying and three and eight weeks later, the parasite, which was low in number before spraying, was greatly reduced by all treatments. Ladybirds became more numerous after spraying, except on fruits from trees sprayed with dimethoate plus white oil.

White Wax Scale, Gascardia destructor

White wax scale was common on citrus trees in coastal areas. Control was not particularly difficult under the weather conditions which were generally satisfactory for spraying during December/January.

Final assessment in July, 1970 of an insecticide screening trial set down at the Horticultural Research Station, Narara in the 1969/70 summer period showed that the new carbamate insecticide pirimicarb, used at 0.05 per cent plus white oil 1/100, was not satisfactory. It was less effective than omethoate at 0.05 per cent plus white oil 1/100, and recommended treatments white oil 1/50, carbaryl 0.05 per cent plus white oil 1/100 and promecarb 0.05 per cent plus white oil 1/100.

Survey of Citrus Insects

A tortricid caterpillar, *Cryptoptila immersana*, was recorded as a pest for the first time. It caused extensive foliage injury to orange trees in an orchard at Kurrajong. Dicky rice weevil, *Maleuterpes spinipes*, rarely seen since 1948, occurred in large numbers at Werombi where it damaged Valencia orange fruit in an orchard in December-January.

The area of distribution of hard wax scale, *Ceroplastes sinensis*, first recorded on citrus in New South Wales in 1967, increased during the year with records at Lower Portland and Ebenezer. It has now been recorded in the Sydney Metropolitan Area, Hills district and Windsor-Hawkesbury River districts.

Queensland Fruit Fly, Strumeta tryoni

Incidence.— Infestation by Queensland fruit fly was much favoured by heavy rainfall in summer in coastal and north western districts. A higher incidence of infestation than usual also occurred elsewhere in the State including south western areas where there were numerous occurrences in districts normally free of fruit fly.

Loquats were heavily infested in coastal districts in October-November; pome, stone and citrus fruit and tomatoes were subsequently attacked. Cherries were infested in December-January in the northern tablelands. Subsequently stone and pome fruits, and ornamental plants became infested. Late in the season quinces were infested in tablelands and western districts.

Severe flooding in many inland towns interrupted suppression schemes, based on male lure trapping and maldison plus protein hydrolysate bait spray normally carried out by Councils. These interruptions, and humid conditions conducive to fruit fly survival, enabled populations to increase considerably during summer and autumn in north western and central western towns.

Despite the use of fruit fly suppression schemes by Shire Councils in and around the Murrumbidgee Irrigation Areas (M.I.A.), infestation developed in Narrandera, Barellan, Moombooldool, Merriwagga and Booligal. Infestation also occurred in the towns of Leeton and Griffith, and in farm areas at Nericon, Yenda, Corbie Hill, Cudgel, Five Bough, Stony Point, Wamoon and Yanco. Immediately to the south of the M.I.A., infestations were found on station properties near the Murrumbidgee River between Narrandera and Darling Point.

Bananas. — The three year programme of investigations at the Citrus Wastage Research Laboratory, Gosford, into disinfestation of bananas against Queensland fruit fly by (a) fumigation with ethylene dibromide (EDB) and (b) dipping in dimethoate, was concluded in late 1970. The research has defined specific conditions for use of each method. Proposals for commercial acceptance are being prepared.

In addition, work with dimethoate simulating commercial conditions confirmed that the active ingredient is removed from solutions of this insecticide during treatment of bananas. The study also provided base data on the replenishment rate for maintaining the chemical in the effective concentration range of 300 to 500 ppm dimethoate.

Tomatoes and capsicums. — Investigations to develop disinfestation treatment for tomatoes and capsicums were commenced at the Citrus Wastage Research Laboratory, Gosford. The work will largely concentrate on fumigation for which modified facilities are being installed.

Techniques for artificial infestation of both fruits were developed. Tomatoes were satisfactorily infested by implantation from a hyperdermic syringe, eggs, being suspended in a broken agar gel containing a disinfectant such as zephiran B to restrict mould development in the fruit. Capsicums can be infested in the same manner, or more simply, by direct egg-laying by caged flies in the laboratory.

After infested tomatoes were dipped in domethoate solution at 21°C for 30 seconds, 21 eggs out of an estimated 5,454 eggs survived in fruit dipped in a 300 ppm solution, and 19 eggs out of an estimated 5,427 eggs survived in fruit dipped in a 500 ppm solution.

Storage in vacuum. — Observations were made on the effect of vacuum as a commodity treatment. Jonathan apples infested with mainly large third instar larvae were held in vacuum (28 in mercury) at room temperature in March for periods of 16 hours and 112 hours. Storage in vacuum for 16 hours was ineffective, mortality of larvae (57 per cent) in the treated fruit being similar to the natural mortality of larvae in untreated fruit. There was 92 per cent mortality of larvae, due to the vacuum plus natural causes, in fruit stored for 112 hours; further, 88 per cent of the larvae which survived the vacuum treatment failed to pupate. However 44 per cent of untreated larvae also failed to pupate.

Avocado Insects

Observations continued on the range of insect pests of avocados.

Spasmodic swarms of red-shouldered leaf beetle, *Monolepta australis*, which appeared with little warning, occurred from late October to January. In the absence of prompt treatment there was serious damage to young foliage early in the season. Later swarms interfered with setting by eating the flowers, or extensively blemished the skin of newly set fruits.

Fruit-spotting bug, *Amblypelta nitida*, attacked fruits at Woolgoolga, Upper Corindi and Mullumbimby from early December, resulting in typical star-shaped lesions. A few bugs can render most fruit on an infested tree unmarketable.

Fruit stung by Queensland fruit fly at Upper Corindi in February had "star spots" very similar to those produced by fruit-spotting bug. Whilst larvae failed to survive, fruit stung was spoiled by the infestation.

Caterpillars of the leaf case moth, *Hyalarcta huebneri*, light-brown apple moth, *Epiphyas postvittana*, and a looper, *Cleora repetita*, at Duranbah in February and blue triangle butterfly, *Graphium choredon* at the Alstonville Tropical Fruit Research Station in March, caused minor damage.

Macadamia Insects

Attacks by insects which feed on foliage during the early years of growth of macadamias can delay tree growth and the production of nuts. Observations were made on the pest species involved in young plantations at Dunoon and on Alstonville Tropical Fruit Research Station.

Growing tips were damaged by Fuller's rose weevil, *Pantomorus cervinus*, at Alstonville where inflorescences were also infested with black citrus aphid, *Toxoptera surantii*. A light infestation by scales, *Eriococcus* sp., was noted. Macadamia nut borer, *Cryptophlebia ombrodelta*, occurred in nuts on the ground.

At Dunoon, larvae of pencilled blue butterfly, *Candalides abailmilis*, attacked very young leaves of nursery trees. A leaf miner, *Acrocercrops chionosoma* and macadamia twig girdler, *Neodrepta luteotactella*, were also recorded.

Banana Weevil Borer, Cosmopolites sordidus

A survey to determine the extent of dieldrin resistance in banana weevil borer on the far north coast was continued. Of 38 samples tested, 34 samples were dieldrin resistant. All resistant samples came from localities centred around the main arm of the Brunswick River, except these from Yelgun, Burringbar and Cooper's Creek.

Since dieldrin resistance was first determined in the banana weevil borer in the Brunswick district in November, 1968, a total of 163 samples from 157 plantations have been tested. Dieldrin resistant weevils have been diagnosed from 85 plantations. At present the dieldrin resistant area extends from Goonengerry in the south to Burringbar in the north and west to Doon Doon. The survey has shown that dieldrin resistance in banana weevil borer is present in 2,250 acres of the 2,450 acres of plantations in this area.

It was confirmed that the dieldrin resistant weevils are also resistant to lindane but there is no cross resistance to chlorfenvinphos, mocap, diazinon, azinphos-methyl and fenitrothion.

A replicated field trials was commenced in a plantation on the main arm of the Brunswick River to compare diazinon, chlordecone, chlorfenvinphos, dieldrin, and BHC sprays against banana weevil borer. Laboratory tests had established previously that weevils from the plantation were resistant to dieldrin. Sprays were applied in late October and early April to the butts of stools and surrounding soil at the rate of 1 lb of active ingredient to 100 gallons of water per acre (800 stools per acre). In the first application diazinon, chlordecone and chlorfenvinphos were equally effective, while BHC and dieldrin were ineffective. However, after six weeks there was a marked reduction in the control afforded by diazinon, chlordecone and chlorfenvinphos. Similar results were obtained from the second application of sprays.

In view of the limited residual effect of these chemicals, emphasis must be placed on thorough plantation hygiene to reduce populations of banana weevil borer in areas where dieldrin resistance is present.

VEGETABLE PESTS

Insects of Crucifers

Ecology.— An investigation of ecological relationships of pest and beneficial species in commercial cruciferous crops was commenced in the Windsor district in early 1971.

Corn ear worm, *Heliothis armigera*, and to a lesser extent, cluster caterpillar, *Spodoptera litura*, were the most numerous pest species from early March to early May. Populations of cabbage white butterfly, *Pieris rapae*, and cabbage moth, *Plutella xylostella*, were low in the autumn.

Parasites observed included *Apanteles rubecula*, *A. glomeratus*, *Diaeretus rapae* (Braconides) and *Netelia* sp. (Ichneumonidae). There were insufficient larvae of cabbage white butterfly in the crop to assess the degree of parasitism until early May when about 20 per cent of late instar larvae were parasitized by *Apanteles* spp. The grey cabbage aphid, *Brevicoryne Brassicae*, was heavily parasitized by *D. rapae* from late March.

Sciapus connexus (Dolichopodidae), predatory shield bug, *Oechalia schellenbergii* (Pentatomidae), transverse ladybird, *Coccinella repanda* (Coccinellidae) and *Sphaerophoria* sp (Syrphidae) were the main predatory insects. Adults of *S. connexus* fed on early instar larvae of cluster caterpillar; the larvae of transverse ladybird and *Sphaerophoria* sp. attacked grey cabbage aphid and the green peach aphid, *Myzus persicae*.

Insecticides investigations. — Base-line data were obtained for a number of insecticides against susceptible grey cabbage aphid, *Brevicoryne brassicae*. Aphids were placed on cabbage leaf discs, previously sprayed in a Potter tower. Mortality records were taken after 24 hours. LC50's were: mevinphos 0.0011 per cent, dimethoate 0.0014 per cent, monocrotophos 0.0016 per cent, demeton-S-methyl 0.0019 per cent, omethoate 0.0022 per cent, phosphamidon 0.0024 per cent, dursban 0.0035 per cent, methidathion 0.0035 per cent and methomyl 0.0044 per cent.

Onion Thrips, Thrips tabaci

A spraying trial was conducted at Maitland in October with DDT 0.1 per cent, methomyl 0.05 per cent and demeton-S-methyl 0.025 per cent against onion thrips. Treatments were applied by knapsack at seven and 14 day intervals for four weeks. Populations of onion thrips were light throughout the trial. Applications of DDT and methomyl at seven day intervals were the most effective. Demeton-S-methyl at seven day intervals and DDT and methomyl at 14 day intervals were less satisfactory. Spraying with demeton-S-methyl at 14 day intervals was ineffective.

Phytotoxicity Trial on Tomatoes

Grosse Lisse, Rouge de Marmande and Floralou tomatoes were sprayed by knapsack with methomyl 0.1 per cent and 0.15 per cent in a further trial at Rydalmere. Sprays were applied at seven day intervals for 11 weeks from January to March. No phytotoxicity occurred.

STORED PRODUCT PESTS

Rust-Red Flour Beetle, Tribolium castaneum

A survey to determine the distribution of maldison resistance in rust-red flour beetle in New South Wales, commenced in 1968, was continued. In tests on 40 samples of rust-red flour beetle from 32 locations, maldison resistance was diagnosed in samples from 15 locations where it had not previously occurred and in three samples from premises where resistance had already been detected. Resistant samples were obtained from three premises where rust-red flour beetle collected previously had been maldison-susceptible. The resistant samples included the first instance of maldison-resistant rust-red flour beetle from grain in farm storage. In addition, two of three samples intercepted in quarantine from vessels at Sydney were resistant.

Confused Flour Beetle, Tribolium confusum

Susceptibility to maldison of four samples of confused flour beetle was determined in the laboratory in August using the method developed for rust-red flour beetle. The response was found to be similar to that for maldison-susceptible rust-red flour beetle.

Control of Grain Insects on the Farm

The pre-harvest incidence of grain infesting insects in harvesting machinery and storages on 22 wheat farms in the Cowra-Canowindra-Grenfell district was investigated in November. Living, grain-infesting insects were found in five of 20 headers examined; grain residue was found in 17 of these headers. Augers were less frequently infested and of 16 trucking bins examined one was infested. The benefits of attending to grain hygiene and using grain-protectant insecticides were observed on two farms where growers were aware of recommendations and all machinery was free of grain-infesting insects. Grain stored either as feed for animals or for seed was insect-infested on 18 of 22 farms inspected and appeared to be the main reservoir of infestation. Grain insects had previously been found in harvesting machinery or grain storages on 14 of 15 wheat farms sampled in the Tamworth district in 1968.

Publicity before harvest once more stressed the need for growers to free handling equipment of insects and to protect grain in storage on the farm. The importance of preventing the delivery of infested grain to bulk handling storages has been publicized before harvest each year since 1964.

At the direction of Standing Committee on Agriculture, CSIRO convened a Committee to investigate the control of insect pests of stored grain on the farm. This Department was among the Government, marketing and grain handling organizations represented. The Committee reported to the Commonwealth and States Entomology Committee and its proposals were considered by Standing Committee on Agriculture.

Aeration of Farm-Stored Grain

An investigation of grain aeration as an aid to insect control for maldison-treated wheat stored in farm silos, commenced at Condobolin Agricultural Research Station in December, 1969, was completed. This project was conducted in co-operation with the Division of Research Stations and the Chemistry Branch. Two silos of 2,000 bushel capacity were fitted with aeration units with different control systems designed to cool grain while limiting the intake of humid air. A third silo was used as an un-aerated control. All silos were filled with wheat treated at intake with 12 ppm maldison.

Grain samples were taken at intervals of two to four months to detect insect infestation and for analysis of maldison residue. Grain moisture content and temperature were determined at the same intervals.

Surface grain only was infested in all silos in October, 10 months after the trial commenced. By February lesser grain borer, *Rhyzopertha dominica*, was established throughout the control silo but occurred mainly on the grain surface in the aerated silos. Rust-red flour beetle, *Tribolium castaneum*, and long-headed flour beetle, *Latheticus oryzae*, were numerous on the surface on the aerated grain where mouse damage had occurred during 1970. It was evident that, 14 months after commencement, aeration was retarding sub-surface infestation. At the final sampling, 17 months after commencement, sub-surface grain in the aerated silos remained very lightly infested compared with the control silo where lesser grain borer and long-headed flour beetle were active in sub-surface samples. There was heavier infestation on the grain surface and at grain outlets in the control silo than in the aerated silos, except that rice weevil, *Sitophilus oryzae*, heavily infested grain in the auger chute of one aerated silo.

Grain temperature reduction achieved by aeration retarded decomposition of maldison and inhibited sub-surface insect activity during storage for 17 months. Aeration failed to prevent insect infestation of surface grain, including that at outlets at the base of the silos, and therefore appeared to be of limited value for short-term storage in farm silos.

Copra Pests

Insect infestation of copra, shipped from the Territory of Papua and New Guinea and Pacific Islands and stored for processing at Sydney, was investigated following the discovery by officers of the Division of Horticulture of heavy infestations of merchant grain beetle, *Oryzaephilus mercator*, at two quarantine copra stores.

Heavy infestation of copra at a quarantine store at Balmain in April by red-legged ham beetle, *Necrobia rufipes*, hide beetle, *Dermestes ater*, and merchant grain beetle was found to be an abnormal condition, probably due to delivery of infested smoked copra from New Guinea in December. This infestation was brought under control in May by processing the infested copra.

Bagged copra from New Guinea, Solomon Islands and Bougainville examined in vessels and on the wharf at Sydney in May appeared to be lightly infested by the insect species already mentioned. In addition dried fruit beetle, *Carpophilus* sp. and foreign grain beetle, *Ahasverus advena*, occurred in copra from New Guinea. Copra, shipped in a large bin from New Guinea, as an experiment in bulk handling, was infested by hide beetle, merchant grain beetle and tropical warehouse moth, *Ephestia cautella*.

Pea Weevil, *Bruchus pisorum*

No infestation by pea weevil was found in 27 samples of field peas grown in the Riverina in the 1970 season. The samples were examined in March. The pea weevil is an established pea pest in Western Australia and South Australia but is not known to occur in New South Wales.

ANIMAL PESTS

Primary Sheep Blowfly

Strains under culture.— The following strains are cultured for resistance studies:

- LS — Laboratory susceptible, from CSIRO, Canberra in 1956. No exposure to insecticides.
- Q — Organophosphorus (OP) resistant, from north west N.S.W. in 1966-67. Selected larvally with diazinon. Larval resistance factor (RF) 40x normal. Also butacarb resistant.
- G — OP resistant and unselected, from north west N.S.W. in late 1966. Larval RF to diazinon 12x normal. Also butacarb resistant.

- RD — Carbamate resistant, from north western N.S.W. in late 1966. Selected larvally with butacarb. Larval RF to butacarb 25x normal. Also OP resistant.
- FDR — Dieldrin resistant, from central western N.S.W. 1970-71. Selected larvally with dieldrin. Larval RF 125x normal.
- TDR — Dieldrin resistant, from Townsville supplied by CSIRO. Selected larvally with dieldrin. Larval RF 125x normal.
- MRS — Multi-resistant (formerly termed CFS), formed by combining 1969-70 field survey strains. Simultaneously selected larvally with diazinon, butacarb and dieldrin.

Selection response.— In an attempt to enhance the order of resistance to OP insecticides the Q strain has been larvally selected with diazinon since late 1968. An increase in the amount of larval pressure, varying from 10 to 100 ppm diazinon, failed to give a selection response during the last year. The strain appears to have reached a ceiling of advance to diazinon in the order of 40x normal.

A further modification has been made to the method used for screening insecticides against larvae. Paper strips are impregnated with a solution made by dissolving candidate chemicals in ethanol. Larvae are placed in small tubes containing treated paper, saturated with serum. Increased resistance factors for butacarb and diazinon were obtained; this is due to a reduction in LC50 figures for the susceptible (LS) strain with the modified test procedure. LC50's for susceptible and resistant strains and RF's are: butacarb LS — 5ppm, RD — 125 ppm, RF — 25x; diazinon LS — 0.07 ppm, Q — 3.0 ppm, RF — 40x.

Screening for alternative insecticides. — In larvicidal activity tests sixty four insecticides (twenty six coded and thirty-eight commercial) were screened; RF's ranged from 1.5 to 56x normal. Two coded carbamates with low RF's are suitable for semi-field testing.

Field surveillance testing. — Adults and larvae from 28 samples of blowflies, obtained from sheep with flystrike throughout the major sheep districts of N.S.W., were tested for resistance to diazinon, butacarb and dieldrin. All strains were resistant to diazinon and, with one exception, were also resistant to butacarb. However, 60 per cent of these strains contained a low frequency of dieldrin resistant flies.

Semi-field studies. — The effects of diazinon at double recommended strength, and diazinon, fenthion-ethyl, dichlofenthion and butacarb at standard concentrations, were compared by making implants with larvae from Q (OP resistant) and RD (Carbamate resistant) strains on treated sheep. The periods between jetting and the establishment of artificial strikes on 50 per cent of sheep in each group were; diazinon, 0.04 per cent — 9 weeks; diazinon, 0.08 per cent — 12 weeks; fenthion-ethyl, 0.05 per cent — 9 weeks; dichlofenthion, 0.05 per cent — 11 weeks; and butacarb, 0.05 per cent — 6 weeks.

The effect of moisture on the degradation of diazinon in the fleece of sheep was assessed at Glenfield Veterinary Research Station. Implants with larvae from the Q strain (OP resistant) were made on groups of sheep, either shower-dipped with water three times weekly, or run under natural conditions. Artificial strikes were established on the showered sheep 30 per cent sooner than in the control group.

Field situation. — Flystrike was prevalent throughout the western slopes and plains in late spring and early summer of 1970, due to favourable conditions for waves of blowflies. A severe incidence of flystrike caused concern in December and early January in the north western plains where the problem was accentuated by the inaccessibility of sheep for treatment due to extensive flooding.

Despite widespread resistance, OP insecticides continued to give control of flystrike for four to five weeks, even in severe fly waves, provided sheep were thoroughly jetted.

DOMESTIC PESTS

Argentine Ants, Iridomyrmex humilis

A publicity campaign based on a cartoon character, "El Argentino", as its key figure, was organized by the Argentine Ant Eradication Committee with the assistance of the 40 Councils covered by the schedule to the Argentine Ant Eradication Act, under the guidance of a public relations consultant. The campaign was initiated on television in late 1970 and supplemented by radio and newspaper coverage during the summer and early autumn. It resulted in the submission of some 12,000 samples of ants, largely through children, and the discovery of two new areas of Argentine

ant infestation, totalling 66 acres. In 1966/67 31 new areas of infestation were reported after a similar publicity campaign which yielded about 15,000 samples of ants. In 1968/69 seven new areas of infestation were found as a result of a publicity campaign which yielded about 15,000 samples of ants.

Apart from the two new areas of infestation found during the publicity campaign in 1970/71 no other new areas were recorded during the year. No new areas had been reported in the previous year. It is therefore possible to be optimistic about eradication of Argentine ants from Sydney and Wollongong. This comment may be applied to the whole of N.S.W. as well because, despite publicity campaigns throughout the State at intervals over the last 15 years, the one infestation outside Sydney and Wollongong was in the Municipality of Shellharbour. That infestation was sprayed and when checked recently no Argentine ants were found. A total of 312 areas of infestation, amounting to 7,576 acres, has been found in the Sydney, Wollongong and Shellharbour areas since the first report in Auburn in April, 1950.

No spraying was required during the year as the two new areas of infestation had not been prepared for spraying by June 30. They will be sprayed in 1971/72.

A check-survey of 28 areas of infestation previously sprayed, comprising 1,546 properties, completed a full check survey of the 310 areas which had been reported to June 30, 1970. No persisting areas of Argentine ant infestation are known to exist.

A survey of garbage and other refuse tipping areas in the various Municipalities and Shires of Sydney and Wollongong was continued and 11 of these were completed without the discovery of Argentine ants. Garbage tips and similar places have proved to give some indication of Argentine ant infestation in a district. The survey was limited in 1970/71 because of staff shortages; two technical assistants were not recruited until October, 1970.

SYSTEMATIC STUDIES

The Insect Collection

This year 11,725 specimens were added to the collection; mainly Coleoptera, Hemiptera, Lepidoptera, Diptera and Hymenoptera. Remounts were made of 5,221 insects, mostly specimens affected by verdigris or mounted on unsuitable pins.

The transfer of the Order Hemiptera to the unitary system, in accordance with the classification adopted in "The Insects of Australia" was completed. Hemiptera now occupy 106 drawers and contain 16,812 specimens.

Families of Coleoptera, Hemiptera, Lepidoptera were indexed alphabetically according to the new system of classification.

Major groups of insects returned from specialists were: Staphylinidae, 405 and Scatopsidae, 88.

Study of Curculionoidea

A total of 1,776 specimens of weevils was added to the insect collection to bring it to 22,932 weevils. Specimens from the following families were added: Belidae 24, Attelabidae 7, Apionidae 45. Sub-families of weevils represented were: Brachyderinae 112, Sitoninae 108, Otioryhynchinae 74, Eramninae 9, Leptopinae 209, Cylindrorhininae 22, Rhytirhinae 23, Diabathrariinae 1, Amycterinae 71, Conipterinae 37, Cleoninae 12, Hylobiinae 49, Erihinae 336, Aterpinae 30, Anthonominae 17, Amalactinae 254, Laemosaccinae 1, Haplonychinae 7, Cryptorhynchinae 156, Rhynchphorinae 122, Cossoninae 7, Barinae 4, unclassified 39.

The study of the taxonomy of curculionid larvae, with special attention to *Trigonotarsus rugosus*, was continued.

A survey of injurious and other noteworthy species was continued; 100 cards were added to make a total of 1,428 records since the survey began in 1958.

CHEMISTRY BRANCH

GENERAL

Administrative

The Deputy Chief Chemist, Dr D. K. O'Neill, was seconded for three months during the latter part of the year to the Department of Environment Control. After his return to the Branch he continued to attend one day per week at the Department, an arrangement which will continue until

the permanent staff of the new Department has been recruited. Prior to this secondment, Dr. O'Neill had been Acting Chief Chemist for several weeks during the absence of the Chief Chemist on electoral duties. During both periods of secondment, Mr. F.W. Cradock was Acting Deputy Chief Chemist.

Obituary

Mr M. G. Chatfield, Head of the Waters, Regulation and General Section, died suddenly on March 13, 1971, three months before he was due to retire. His enthusiasm and devotion to his work are among the fine qualities which will be long remembered by those who worked with him.

Conferences and Visits

Geological symposium. — The Chief Chemist and Mr A. M. Riddler attended the Sixth Symposium on "Advances in the Study of the Sydney Basin" at the Department of Geology, University of Newcastle.

Metric conversion. — The Chief Chemist represented the Department, in the absence overseas of the Director of the Institute, at a meeting of the Metric Advisory and Co-ordinating Committee.

Royal Australian Chemical Institute, Cereal Chemistry Division. — Messrs. Almgren, Chesterfield and Jacob attended the 20th Annual Conference of the Cereal Chemistry Division of the Royal Australian Chemical Institute in Canberra. The overseas lecturer, Professor K. Gilles of the University of North Dakota, visited the Institute during his post conference tour.

Following the conference Mr. Jacob chaired a meeting of cereal chemists representing all mainland States to discuss: the rules of nomenclature of cereal varieties in Australia; standardization of methods of assessment; standardization of reporting of quality data in applications to the Registrar of cereal varieties; market evaluation and reports from marketing authorities to assist State chemists in evaluation of breeding material; and the requirement of the Agricultural Council that N.S.W. should draft legislation for cereal registration.

Cereal Chemistry Symposium. — Members of the cereal section attended a Cereal Chemistry Symposium organized by the CSIRO Wheat Research Unit at North Ryde. The Symposium was subsidized by the Wheat Industry Research Council. Delegates from all States attended.

Australian Cereal Agronomy Conference. — Mr. Jacob attended the Australian Cereal Agronomy Conference in the Riverina. Wheat marketing and wheat quality made up a significant portion of the agenda in contrast to the first Cereal Agronomy Conference five years ago.

Hard and Soft Wheat Growers Association. — Mr. Jacob attended the Annual Conference of this newly formed Association at Wagga in February, 1971. The Association, in its second year of operation, was responsible for segregation of over one million bushels of the varieties Eagle and Falcon at 18 silos in southern and western New South Wales.

Plant Breeders' Seminar. — Members of the cereal section attended a seminar at the University of Sydney with Dr. Belderok, of the University of Wageningen, an authority on sprout and weather damage in wheat.

Weeds Conference. — Mr M. Glennie-Holmes of the pesticides section attended the Fourth Australian Weeds Conference at Hobart.

Water analysis. — Officers of the waters section attended a symposium on salinity problems in Mildura, a CETIA symposium in Sydney and the Fourth Federal Convention of the Australian Water and Waste Water Association.

Plant nutrition. — Mr. Weir of the plant nutrition section attended a one-week refresher course at the University of Queensland.

Interpretation of aerial photographs. — Mr. Riddler of the soils section attended a course in Aerial Photographic Interpretation at Sydney Technical College.

Third Australian Soil Conservation Conference. — Mr. Riddler of the soils section attended the Third Australian Soil Conservation Conference in Melbourne.

Awards of Doctorates of Philosophy

Dr David R. Leece returned after three years' study leave at Michigan State University under the direction of Dr A. L. Kenworthy, Professor of Horticulture. Dr Leece was awarded the degree of Doctor of Philosophy for studies in plant nutrition. His thesis was "Absorption and Utilization of Foliar-Applied Nitrogen in *Prunus* sp."

Dr T. S. Abbott returned to the Branch after study leave in the Faculty of Agriculture, University of Sydney, where he was awarded the degree of Doctor of Philosophy for his work in soil physics. His thesis was "Liquid Movement through a Swelling Clay".

CEREAL CHEMISTRY SECTION

Laboratory Output and Statistics

Fewer samples. — Samples of wheat, flour and other grains for testing totalled 2,051. This was fewer than in the previous year mainly because the number of samples from northern areas was reduced by weather damage following heavy rain at harvest time. The work load of the laboratory was not reduced because of the additional work in small scale milling on every silo sample to assess possible weather damage prior to making up the official standard samples. Some of the sources of the wheat received for testing were 98 samples for Uniform Quality Testing, 361 samples from 1/40th acre and plant breeders' trials and 664 wheat samples from District Agronomists' trials. Results of small scale tests on samples from District Agronomists' tests were forwarded to them for extension use. This type of reporting was fully established in the previous year and was favourably received.

Range of physical and chemical tests. — Almost 15,000 laboratory operations, apart from milling and baking, were undertaken on wheat and flour samples.

Flour ashing figures were down to 136 reflecting a further decrease in flour export samples requiring certification. Farinograph (466) and extensograph (186) tests were equivalent to one year's full-time work by one technical assistant.

The number of milling units completed for the year (932) was only five more than for the previous year. It would have been much greater but for interruptions caused by the installation of air-conditioning in the mill room. The number of test loaves from the experimental bakery fell by 390 to 1,970 loaves because it was necessary for the bakery cereal technician to be employed for part of the year in preparing and receiving samples.

The 1970/71 Wheat Crop

Seven grades:— The 1970/71 crop suffered because a dry winter delayed sowing. Then, at harvest, excessive rain caused extensive damage, particularly in the north and north-west. Seven standard grades of wheat were declared for the season: Prime Hard, Northern Hard, Northern weather damaged, Northern F.A.Q. N.S.W. Hard (Falcon), South-western F.A.Q. and N.S.W. Off-grade.

Additional testing:— The Cereal Chemist represented the Department as a member of the Wheat Standards Committee which examined all bulk grain receivals and decided on the grades to which the various parcels from each silo would be allocated. To assist in making these grade placements, over 400 samples were given tests additional to those normally undertaken on behalf of the Grain Elevators Board. The additional testing involved the milling of all the samples and a Hagberg test on the flour. This test is an international method, measuring weather damage in wheat caused by rain during the ripening period. Rain during ripening increases the alpha amylase activity and flour is unsuitable for commercial bread production if the activity is excessive.

Export Certification

During the year, 46 shipments of wheat were certified of which 34 were from Sydney and 12 from Newcastle. Requests for certification by Egypt have made up for the decrease in certification of wheat for China. The number of flour ships for which certification was required was six, compared with seven in the previous year. In addition certification was required for a consignment of barley and one of maize.

Sorghum was of increasing importance. Most was exported to Japan although some was shipped to Taiwan through Japanese agents and some to New Zealand. A total of 10 shipments were certified representing over 107,000 tons of which 70,475 tons were from the current season. The first sorghum harvested was affected by weather damage but later batches were very sound and very clean. No difficulty was found in meeting the buyers' specifications.

Mercury Residues in Export Wheat

In October, a complaint was received from a European market that wheat shipped from Newcastle contained mercury residues to the order of 5 ppm. Analysis of samples in the Chemistry Branch gave readings of only 0.02 ppm. This reading is at the limit of the apparatus used for analysis so there may not have been any mercury present.

Indicators of treated seed wheat are red and it was felt that the complaint was associated with a high proportion of pink grains in the shipment. A pink colour can be caused by the fungus *Helminthosporium tritici-repentis* which is quite often found in wheat exposed to wet and humid conditions at harvest time. Nevertheless the possibility of mercury-treated seed being accidentally included in an export wheat shipment is always present. The report initiated a publicity campaign by the Australian Wheat Board to inform growers of the dangers to marketing if even a small proportion of treated seed wheat enters commercial channels.

Uniform Quality Testing of Wheat

The Cereal Chemist convened two meetings of the Uniform Quality Testing Sub-committee to consider qualities of the northern crossbreds Gatcher and 8127-266, the southern crossbreds M1224/2 and the Victorian variety Summit. Summit was considered as a possible replacement for the variety Pinnacle in dryland areas only.

R.A.S. Wheat Judging (Open Classes)

The cancellation of the Open Wheat Classes for the 1971 Royal Show, following the fire in the Agricultural Hall, relieved the cereal chemists of judging duties.

State Wheat Improvement Committee

The State Wheat Improvement Committee, of which the Cereal Chemist is a member, met twice. The second meeting was held to discuss the proposals to be placed before the Standing Committee on Agriculture for the drafting of legislation and the possibility of licensing wheat varieties. Prior to this special meeting, the Legal Officer, Principal Agronomist, (Cereals), and the Cereal Chemist met representations of the major wheat growers' associations in N.S.W.

The regular July meeting of the Committee considered reports of the Uniform Quality Testing Committee. It decided that the University-bred variety Gatcher would be recommended to the Standing Advisory Committee on Wheat as a suitable replacement for the variety Mendos in the northern areas of the wheat belt. The Committee deferred any recommendation on the crossbred M1224/2 which had been uniform-quality-tested for the two previous seasons. It was decided that a sub-committee would examine crossbred 8127/266 after the 1970 harvest. This is a rust resistant line from the Tamworth programme which has given variable results in quality assessments but has excellent field characteristics.

Air Conditioning of the Mill Room

Installation of air conditioning of the experimental mill room was in progress for the second half of the year. The system has been designed to control both temperature and humidity within small tolerance as milling behaviour of wheat samples can be greatly influenced by variations in these two factors. The installation is being undertaken by Department of Public Works with funds from the Commonwealth Extension Services Grant and State funds.

Grain Drying and Moisture Determination

Trials were undertaken in collaboration with the Agricultural Engineering section on grain drying and moisture determination methods with both maize and sorghum. A more intensive trial is being planned to assess more critical levels of temperature as they affect baking quality in wheat. Excessive temperature destroys the gluten's ability to form normal bread and the possibility of damage to wheat by overheating is becoming more likely with the installation of more grain dryers in the north of the State. These dryers are designed for coarse grains and are using higher temperatures and shorter times to increase throughput of sorghum and maize. If the same conditions were applied to near ripe wheat, to minimize harvest damage due to possible rain, the high temperatures could have serious consequences.

Starch Quality

Investigations of starch quality of wheat continued. The starch quality of a variety is affected by: the amount of alpha amylase present in the flour; the susceptibility of the raw starch granules to alpha amylase; the gelatinization temperature of the starch; the inherent starch strength; the starch granule size distribution; and the degree of starch damage. The two principal techniques of quantitatively measuring starch quality, the amylograph and the falling number method, are being used.

Progress was made in the alpha amylase studies. The standard method for determining alpha amylase in cereals is that of the International Association of Cereal Chemists. It requires considerable preparation, is time consuming and is not suitable for handling large numbers of samples. A new and rapid method was first reported in the United States in 1967 for determining alpha amylase in

human blood serum as a diagnostic technique for pancreatitis. The new medical method is based on the principle that alpha amylase acts on a dyed preparation of amylose and amylopectin. The dye is released in proportion to the amount of alpha amylase present. The method required considerable modification before it could be used in cereal chemistry.

Beta amylase is not present in animal tissue. But it is present in abundance in cereal grains, and precludes direct use of the medical method for determining alpha amylase. The problem was overcome by using granular cereal starches which are not attacked by beta amylase and possess a degree of susceptibility to alpha amylase. Granular starches of Timgalen, Falcon, Olympic, Spica and Heron were prepared and dyed. Timgalen granular starch proved completely satisfactory; the release of dye was linear with alpha amylase attack up to an absorbance of 0.80. It would be a suitable substrate for application of the test. The remaining varieties were less suitable, particularly Heron which showed practically no release of dye.

Further work is aimed at developing the test as a quantitative measure of alpha amylase in terms of the International Enzyme Unit. This would have considerable advantages over current methods which use arbitrary units of measurement.

The test should be of use to plant breeders in screening plant material for alpha amylase levels because of the small sample needed (one gramme of wheat) and its speed. There is some evidence to suggest that varieties differ greatly in the rate at which alpha amylase is generated when the grain is wetted, as in rain damage on the standing crop. Selection for a low rate of generation could provide a means of developing varieties with resistance to weather damage.

Measurement of Grain Hardness

The Bread Research Institute has adopted the barley pearler in place of the slower particle size index for measuring grain hardness and other laboratories have shown interest.

The use of the barley pearler as an instrument for measuring grain hardness was developed in the cereal section. It is now used by the section as a routine procedure and to assess samples of daily receivals at "prime hard" sites for the Grain Elevators Board of N.S.W.

Rice Chemist

The rice quality chemist took up permanent appointment at Yanco after twelve months in-inservice training in the cereal section. Rice quality research included testing of methods for the rapid determination of amylose which is important in rice cooking quality and examination of water uptake capacity of a number of varieties to assist the Rice Growers' Co-operative Mills in their project on parboiling. The chemist became familiar with cereal laboratory evaluation techniques and took part in the project on the rapid determination of alpha amylase in wheat starch.

PESTICIDES SECTION

Analyses

The number and variety of formulations and residues analyses were similar to the previous year. Increasing attention was given to environmental contamination as a result of large-scale or non-recommended pesticide usage. Residues studies were supported by funds from the Commonwealth Extension Services Grant, and grants from the poultry and dairy industries.

Collaboration With Other Organizations

Collaboration continued with the Egg Marketing Board in relation to methodology and the analysis of eggs and feeds, with the National Parks and Wildlife Service and the State Fisheries Branch in the sampling of wildlife for environmental studies, with the Commonwealth Department of Primary Industry in the evaluation of thiabendazole residues on citrus and with the University of Sydney in the DDT analysis of eggs and feed samples.

Equipment

The operation of the gas chromatograph was improved by the installation of make-up gas facilities, the preparation of more stable and higher resolution columns, and application of an improved method of cleaning the electron capture detector. The ultraviolet/visible recording spectrophotometer, which has been employed for residues and formulations research for 10 years, broke down and could not be used for the last third of the year. Several important formulations and residues projects ceased as a result.

Herbicide Residues

Analysis of soil samples from Yanco Agricultural College and Research Station continued. The project was designed to determine the probability of damage to rice, a susceptible crop, sown after maize in soil previously treated with atrazine. No residues were detected (< 0.05 ppm) in the soil by an infra-red technique ten months after treatment, and the rice plants showed no ill-effects. The measurement of residues at a lower level, significant for soybeans and other highly susceptible crops, requires the use of more sensitive techniques, for example gas liquid chromatography, and more rigid clean-up procedures.

Fruit Dip Investigations

Work on post-harvest dipping of fruit mainly centred on benomyl, a new fungicide for citrus and bananas.

Dipping experiments on citrus have shown a satisfactory strip rate and a topping-up procedure has been developed for commercial use. It is likely that citrus will be dipped in 500 ppm (nominal) dips.

Work on banana dips have been delayed by instrumentation difficulties and cleanup problems. Work is proceeding on developing suitable methods for the analysis of benomyl in citrus dips for use in packing houses. A colorimetric procedure is being investigated.

Thiabendazole Residues in Citrus

A collaborative test was conducted with the South Australian and Queensland State laboratories and the Victorian Customs and Excise Department to evaluate two methods for determining thiabendazole residues in citrus fruit. The test was under the auspices of the Commonwealth Department of Primary Industry. Fruit was treated by two different methods at the Citrus Wastage Research Laboratory, Gosford. Residues were analysed by a colorimetric procedure developed by the Chemistry Branch and a commercially developed spectrofluorometric method. Excellent agreement was obtained in three of the four participating laboratories using both methods. The colorimetric procedure, although slower, could be used in laboratories where a spectrofluorimeter was not available.

Pesticide Residues in the Namoi Cotton Area

Analysis of samples from the 1969/70 survey of the Namoi cotton area to assess environmental contamination were completed.

The presence of DDT in the river and its flora and fauna implied some movement of pesticide beyond its point of application. However, in view of the quantities of DDT applied annually, the general level of contamination was low.

Maximum DDT residues were only 0.6 parts per thousand million in river water, 3.6 parts per million (ppm) in sediments, 7 ppm (dry weight) in algae, 13 ppm in mussels (fresh weight) and 0.3 ppm in crayfish (fresh weight). Levels in several species of fish were always less than the permitted 5 ppm F.D.A. tolerance. Although appreciable quantities of DDT were sometimes found in birds, for example, up to 30 ppm in fat from ducks, most species collected were migratory and the proportion of the residue resulting from cotton spraying is difficult to assess.

Mercury Residues in Eggs and Poultry Feed

A three-month survey investigated the incidence of mercury residues in commercial eggs and in wheat for poultry feed. The survey followed a trial which demonstrated that feeding of mercury-treated grain to hens resulted in appreciable quantities of mercury residues accumulating in eggs and other tissues. Eggs from 43 farms and wheat from 15 feedmills were examined. Mercury was not detected in any of the samples, if mercury was present, the quantities were less than 0.02 ppm in the eggs and less than 0.05 ppm in the wheat.

The survey indicated that the misuse of mercury-treated seed wheat is not widespread in New South Wales.

Insecticide Residues in Dairy Cattle

During 1969/70, approximately three-quarters of the dairy and beef fat samples monitored by the Board of Tick Control Laboratory contained dieldrin residues ranging up to F.D.A. actionable levels. One source of this dieldrin could have been a recommendation by the Department of a soil application of dieldrin in the establishment of legume pastures.

The residue hazard arising from the soil application of dieldrin is being assessed in a trial at Wollongbar Agricultural Research Station. Pastures are being established for the trial and grazing will commence in 1972. Analysis of milk from five herds owned by the Department has established that at least two herds contain animals with sufficiently low dieldrin residues for use in the trial. A biopsy technique is being investigated at the Cattle Tick Research Station at Wollongbar in an attempt to overcome difficulty in obtaining adequate bodyfat samples.

DDT Residues in Rice

DDT residues in paddy rice and rice stubbles from aerially sprayed crops were studied in the Leeton and Griffith districts to assess the residue hazard to sheep grazing the stubbles after harvest. Residues in 47 samples of paddy rice ranged from 0.03 to 20 ppm (average 3.3 ppm) and those in 43 samples of stubble ranged from 0.1 to 40 ppm (average 8.7 ppm).

It was shown previously that the average DDT residues in subcutaneous fat increased fivefold as a result of six weeks grazing of a paddock after harvest where the stubbles contained 10.8 ppm DDT and the paddy rice 0.2 ppm DDT. Some of the samples from this survey contained much higher amounts of DDT than found in the grazing experiment so the residue hazards could be higher than previous work indicated. Grazing of sheep on some of these DDT treated areas could lead to the accumulation of residues above the revised tolerances for animal fat.

Dieldrin Residues in Birds

A survey, started in 1970 in co-operation with the National Parks and Wildfire Service to assess the possible hazards to wild birds from a dieldrin treatment of aerially sown pasture seed, was continued.

Dieldrin was detected in all samples except one of 26 birds of nine species from an area near Bathurst when the treatment had been applied. The highest residues were found in ground feeding seed eaters such as rosellas, magpies and choughs. All three birds of three species from an area not treated contained low amounts of dieldrin. Further samples, mainly of the ground feeding seed eaters, are needed to evaluate the effect of the dieldrin seed treatments fully.

Diazinon Residues in Wool

Diazinon residues in wool were analysed for a trial conducted by the Entomology Branch to study the effect of excess moisture on the degradation of diazinon. Two groups of sheep were jetted with diazinon: one was kept dry as a control and the other exposed to artificial rain of 300 points a week. Samples of wool were taken at weekly intervals for five weeks after jetting. Although the residues fell more rapidly in the group exposed to artificial rain, substantial residues still remained after the equivalent of 15 inches of rain over 5 weeks.

Fruit Residues

Residues of benomyl in sprayed apples.— In a powdery mildew trial conducted by the Biology Branch at Bathurst Agricultural Research Station, apple trees were sprayed six times with 0.0125 per cent and 0.025 per cent benomyl at least four months pre-harvest, and the fruit analysed for benomyl residues. Benomyl was not detected (<0.1 ppm) in the whole fruit from any of the treatments. The absence of residues was probably due to dissipation over the long period between last application and harvest. The National Health and Medical Research Council has set a 5 ppm provisional tolerance for benomyl in pome fruits.

Residues of thiabendazole and dimethoate in dipped bananas.— A commercial scale trial was conducted with the Division of Horticulture at Alstonville Tropical Fruit Research Station with a mixed 0.04 per cent thiabendazole and 0.05 per cent dimethoate dip. Samples of dipped fruit were stored at 55°C, for various periods up to five weeks before analysis. Although residues were always well within tolerances set by the National Health and Medical Research Council, levels in the edible pulp of thiabendazole and dimethoate in the edible pulp were not diminished by storage.

Residues of thiabendazole in dipped stone fruit.— Fresh apricots were experimentally dipped in thiabendazole concentrations ranging from 0.02 per cent to 0.32 per cent at Yanco Agricultural College Research Station. Residues ranged up to a high 37 ppm, and were noticeably greater than those obtained previously for peaches. Samples of cherries experimentally dipped in 0.016 per cent and 0.064 per cent thiabendazole at the Division of Food Research, CSIRO, Ryde, showed residues ranging up to 0.42 ppm. The National Health and Medical Research Council has not set tolerances for thiabendazole in stone fruit.

Pesticides Residues in Stock Feeds

The accumulation of pesticide residues in animals and animal products, for example, milk and eggs destined for human consumption, necessitated amendments being proposed in 1970 to the Stock Foods and Medicines Act, 1940, to control the levels of these pesticides in stock foods. Approximately 30 samples of feed components and commercially formulated feeds have been analysed for pesticides under the Act. Only a very small proportion of them had levels which exceeded the tolerances; they were usually associated with HCB treated seed wheat. Where excessive levels occurred, the contaminated feedstuffs were destroyed and the persons concerned were warned that prosecutions would be launched if future breaches were detected.

Large amounts of silo dust have accumulated at the Newcastle wheat terminal. At the request of the Grain Elevators Board, samples were analysed for pesticide residues to assess suitability of the dust for stock feed. The amounts of maldison, gamma-BHC and DDT present exceeded the tolerances allowed under the Act.

Miscellaneous Residue Analyses

Miscellaneous residue analyses included samples concerned with suspected poisoning of animals and plants. Residues of 2.6 – 4.0 ppm aldrin and 1.0 – 1.6 ppm dieldrin were detected in two comb foundations suspected to have killed bees. Of two unused foundations, one contained only traces of these pesticides, but the other contained 5.2 ppm aldrin and 1.3 ppm dieldrin. In a case of poisoning of cage birds, the millet seed used as feed contained residues of up to 20 ppm dieldrin and 1.3 ppm aldrin.

Arsenic is the most common cause of accidental or deliberate plant poisoning. No deficiencies in active ingredient or formulation stability were found following complaints of ineffectiveness in agricultural chemicals.

WATERS, REGULATORY & GENERAL SECTION

Water Analysis

Water testing services, provided in the nine agricultural regions and two major irrigation districts of the State, as well as from Rydalmere, continued to be of assistance to primary producers and the Water Conservation and Irrigation Commission. The decentralized services in regions can provide simple water analyses readily and aid officers in giving advice quickly.

During the year, 575 water samples were analysed at Rydalmere and 2,222 water and soil samples were dealt with at regional offices.

The service was particularly valuable in the Mid Coast and Hunter Region. Of the 813 soil and water samples received, 777 were water samples for testing and evaluation for irrigation and stock use. Many were marginal for irrigation. In this Region, there is increasing pressure to use water of marginal quality but so far there have been no reports of crop or soil damage following their use for irrigation.

The Lower Murray office at Dareton continued to monitor the salinity levels of the Murray and Darling Rivers so that local irrigators can be aware of salinity increases that might damage irrigated plants.

Liddell Power Station, Muswellbrook

Macquarie University is investigating the thermal alteration of chemical and biological characteristics of the dam water used for recirculated cooling of the Liddell Station. Assistance was provided by the Chemistry Branch with an extensive range of chemical analyses on 119 "pre-thermal" samples.

Problem Waters

The presence of soluble iron salts in both surface and underground water intended for irrigation and rural domestic use posed some problems. Many waters that are suitable for irrigation by conventional methods are now being applied by trickle irrigation. Waters that are high in "temporary hardness" are unsatisfactory for trickle irrigation because the equipment is likely to be blocked by scale.

Waters suspected of being polluted increase each year. Most samples are submitted by the Water Conservation and Irrigation Commission, but many are received direct from primary producers.

Stock Feeds

The number of registered stockfeeds analysed increased to 248. A quarter of the samples deviated significantly from the guaranteed analysis in one or more of the constituents-protein, fat and fibre. The largest proportion of brands breaching the provisions of the Stock Foods and Medicines Act were produced by country manufacturers; four out of five samples from one manufacturer in the central west failed to comply.

Complaints regarding canned pet foods were investigated. Some samples were found to be below the manufacturer's guaranteed standard, one in particular being grossly deficient in nutritive value.

To ensure full compliance with the Stock Foods and Medicines Act, it is proposed to increase the range of analyses on registered stockfeeds to include additives, such as drugs, vitamins, antibiotics and minerals. This has not been possible previously; only the relatively rapid and simple analyses have been performed.

Revision of Stock Foods and Medicines Act

A final draft of a revision of the Stock Foods and Medicines Act was prepared. Specialists from the stockfeed industry gave valuable comment and advice on proposed new regulations and quality standards.

Margarine

Cooking margarines sampled from retail outlets have been checked regularly for conformity with the requirements of the Dairy Industry Act.

Fatty acid analyses by gas chromatography showed that all samples complied with the definition of cooking margarine in that they contained at least 90 per cent animal fat. The remaining portion usually consisted of one of the polyunsaturated oils, such as sunflower or safflower, or coconut oil. All of the polyunsaturated table margarines tested were found to be produced entirely from suitable vegetable oils, as claimed by the manufacturers.

Vegetable oil-based milk substitutes, such as powdered coffee whitener, and other non-dairy fatty products, including whipping powders and cake shortenings, were analysed to check the composition of oils and fats currently being marketed for these purposes.

Oilseeds

Samples of sunflower seed grown by farmers in an experimental comparison with other summer crops in the Coonabarabran and Dubbo districts were examined for oil yields, which were in the region of 37 to 39 per cent. Other sunflower seed samples representing export shipments contained up to 45 per cent oil. Rapeseed grown in the Gunnedah district yielded 37 per cent oil.

Drought Feeding of Sheep - Research

Analytical work was completed for a sheep drought feeding experiment at the Wool Research Laboratory, Trangie. Over 1,000 samples, including feed, faeces, urine and blood plasma, were analysed to provide nitrogen balance data. A new auto-analyser technique was used for blood plasma and urinary urea determinations.

Selenium in Animal and Plant Nutrition

Research into biological and chemical aspects of selenium compounds continued. Several organo-selenium compounds and a number of pure, naturally-occurring fatty acids were prepared. From these it is hoped to make other, more complex organo-selenium compounds which are biologically active and therefore can be used as a source of selenium, a very important micro-nutrient in animal diets.

PHYSICAL CHEMISTRY SECTION

X-ray Spectrograph

Calibration of the X-ray spectrograph for major elements was completed. A laboratory attendant was appointed to prepare samples for analysis.

Atomic Absorption Spectroscopy

Atomic absorption spectroscopy has continued to play an important role in analytical work for both the plant nutrition and soils sections. Analyses included 4,764 samples by the plant nutrition section for calcium, magnesium, sodium, potassium, copper, zinc, manganese and iron; and 3,400 samples by the soils section for exchangeable calcium, magnesium, sodium, potassium. In addition some samples were analysed for manganese. The atomic absorption spectrophotometer will be used for mercury analysis early in the forthcoming year as the necessary accessories arrive. A new non-flame technique will be applied which depends on the fact that mercury vapour is extremely volatile.

Sulphur Analysis

Sulphur determinations on the atomic absorption spectrophotometer have been delayed by the difficulty of introducing a new digestion method involving the use of perchloric acid without the presence of sulphuric acid. This method is potentially hazardous unless strict temperature control is maintained.

Phosphorus and Nitrogen Determinations by the Auto-analyser

The auto-analyser continued to play an important role in the determinations of phosphorus; 2,178 samples were analysed by this method.

A method was developed to overcome the problem previously encountered when the analysis for nitrogen in plant material was attempted. The previous method was pH dependent and suffered from interferences due to the presence of other elements such as manganese. The new method introduces a distillation step into the analytical train of the auto-analyser. Urea nitrogen determinations on urine and blood plasma were carried out satisfactorily for Trangie Agricultural Research Station with the auto-analyser.

PLANT NUTRITION SECTION

Statistics

A total of 44,179 analyses were carried out on 8,035 samples. Most of the samples, 79.5 per cent, were from trials; 15.5 per cent were diagnostic; and 5 per cent were for surveys.

Diagnosis

Diagnosis of nutritional deficiencies is one of the most important aspects of the work of the plant nutrition section. It includes analysis of samples submitted by extension officers, recognition of symptoms, research leading up to diagnosis, including determining critical levels, and interpretation of analyses.

Emphasis in the problems for diagnosis varies from year to year and depends partly on the weather. This year boron deficiency was prevalent in lucerne and other crops particularly in the central and southern tablelands and slopes. Manganese toxicity and molybdenum deficiency were diagnosed in a wide range of crops and pastures from diverse situations. Deficiencies and toxicities were diagnosed in a wide variety of pasture plants, grain and fodder crops, vegetables and fruits. Specimens were received from most parts of the State.

Photography and Diagnosis

Deficiencies and toxicities encountered have been photographed. The colour slides and black and white prints are used in publications, in extension work by the Department and commercial firms and for teaching at colleges and universities. A publication has been prepared which illustrates and describes the common deficiencies and toxicities in crops, pastures and fruit trees in New South Wales. Printing is being financed by funds from Commonwealth Extension Services Grant.

Analyses and Methodology

There has been a steady improvement in instrumentation and methodology over several years, but this year there was a spectacular advance.

Despite difficulties due to a shortage of chemicals, the work carried out in the section increased substantially, both in the number of samples analysed and the number of individual analyses. The total number of analyses rose by over 25 per cent from 35,249 to 44,179. Atomic absorption analyses, determining eight essential elements commonly deficient in plants, increased by 40 per cent, boron analyses by 50 per cent, chlorides by 30 per cent and molybdenum analyses increased threefold.

Molybdenum Analysis

A very sensitive test for molybdenum, based on its reaction with toluene-3, 4-dithiol, was developed. The test allows routine measurements down to one-tenth of a microgram of molybdenum. This has increased the diagnostic value of the analysis and permitted its application to samples which were too small for analysis by the previous method. The new technique is at least twice as rapid as the superseded procedure.

Savings in Chemicals

Supplies of chemicals used for leaf analysis were short in the last quarter of the year. The principal shortages were of caustic soda and sulphuric acid which are used in relatively large amounts for Kjeldahl determination of nitrogen in about 5,000 plant samples each year. Fortunately, streamlining of techniques in recent years has resulted in a considerable saving of reagents in the analysis of the other major and minor elements, as well as in saving time.

The current methods of atomic absorption analysis, using a dry ashing technique, require only minimal quantities of acids and reagents compared to the wet acid digestion techniques formerly used. From a dry-ashed, two-gramme plant sample, potassium, calcium, magnesium, sodium, manganese, zinc, copper and iron can be determined by atomic absorption. Boron and phosphorus are now determined from aliquots from the same ash. Most phosphorus determinations are now carried out on the auto-analyser and this further economizes on acids. Other procedures, such as the use of the nitrate sensitive electrode, also minimize the use of reagents. A further saving of sulphuric acid has been achieved by the discovery that residues from boron determinations can be used for Kjeldahl digestions, without error.

Liaison with Industry

Liaison with industry continued. Attempts were made, where possible, to provide advice and research assistance.

Spent superphosphate.— The value of superphosphate made from spent acid was assessed in glasshouse experiments. The test fertilizer compared favourably with standard superphosphate and no toxicity could be found from the test material. Spent sulphuric acid is a residue from industry and is a good deal cheaper than commercial acid. Superphosphate made from spent acid could be cheaper and imports of sulphuric acid and sulphur could be reduced.

Asparagus.— A new company developing sandy soil on the far north coast for asparagus culture was assisted. The sand is practically devoid of nutrients. Advice was provided in the field and work was carried out in the glasshouse to define nutrient deficiencies and study the mineral balance in relation to asparagus culture particularly at the establishment stage.

Pilot studies in growth chambers indicated that multiple deficiencies were present. Even after lime, nitrogen, phosphorus, potash, sulphur and molybdenum were applied, a very large response was obtained to other trace elements.

Slag from steel works.— Australian Iron and Steel has sought means of using by-product slag from the steel works as a source of lime. Space to dump surplus slag from the steel mills is scarce, hence the search for other ways of using it. Efficiency of different types of slag and different degrees of grinding were tested and compared with agricultural lime as a means of overcoming manganese and aluminium toxicities.

Fine-ground samples of slag tested were a little less than half as effective as good agricultural lime. Course slag was not effective. The slag provides appreciable amounts of manganese, zinc and boron. Despite relatively high amounts of aluminium and manganese in the slag, the trials indicated that it is capable of correcting both manganese and aluminium toxicities in acid soils if applied at high rates.

Ammonia liquor.— Australian Iron and Steel forwarded a sample of ammonia liquor by-product from its works to be tested as a nitrogenous fertilizer and to determine whether impurities are likely to cause toxicity in plants. Glasshouse trials are being designed to evaluate this material.

Tomato meal.— A company processing 8,000 tons of tomatoes annually is interested in using between 100 and 200 tons of by-product tomato meal derived largely from skin and seed residues. An analysis showed 3.5 per cent N, 0.5 per cent P and 0.8 per cent K. While the analyses are lower than those of cottonseed meal with 6 per cent N, the nitrogen content is as high as good grades of poultry manure and higher than most animal manures.

Zinc Deficiency in Maize

Long-term trials were established on zinc deficiency in maize. The first sowing and harvest were completed. In comparison of initial treatments with zinc sulphate, soil dressings which had been thoroughly incorporated with the soil appeared to be the best method of zinc application. This was contrary to some previous beliefs and results. It had been believed that zinc was so firmly fixed in the soil that soil applications of zinc would be unavailable to plants. The evidence now is that zinc is highly insoluble in the soil and there is no marked fixation. Zinc is quite immobile in the soil and stays precisely where it is placed. This affects plant nutrition. In glasshouse trials surface and drilled applications of zinc compounds were inferior to thorough incorporation of zinc through the soil. A placement effect, reducing availability, also occurs with pelleted or even coarse particles in some zinc fertilizers; finely divided zinc, whether soluble or not, thoroughly dispersed through the soil gives greatest efficiency.

On one trial, correction of zinc deficiency by incorporating zinc throughout the soil, gave outstanding results. The yields were: with no zinc — 0.06 bushels per acre; with dusted seed and spray — 30 bushels; with 5 lb zinc per acre — 46 bushels; and with 25 lb zinc — 94 bushels.

Molybdenum Content of Hybrid Maize

The effect of spray applications of moderate rates of sodium molybdate in raising grain molybdenum was tested on a crop of GH128 maize. The aim was to find a method of raising grain molybdenum without using continued heavy applications of molybdenum to the soil which it is feared could adversely effect livestock in copper deficient areas. Sprays with 0 or 4 oz sodium molybdate per acre were applied at 8 — 10 inches height, 24 — 36 inches height and at tasselling.

All spray treatments substantially increased molybdenum to a relatively satisfactory level (0.06 ppm). The later spray treatments were most effective than the first spray. There was some indication that the third spraying was slightly more effective than the second spray. However, spraying at tasselling would need to be done by aircraft and so would not be applicable to coastal maize. Spraying at up to three feet in height appeared to be the most promising treatment.

Stone Fruit Nutrition

Foliar sprays of nitrogen. — Interest has been shown by fertilizer firms in the possibility of using foliar-applied nitrogen, potassium nitrate or urea, to supplement soil-applied nitrogen for stone fruit trees.

Foliar sprays of potassium nitrate were applied to young, nitrogen-deficient peach trees in two experiments over a two year period at rates three to six times those applied commercially. Urea was compared with potassium nitrate in one year.

Neither autumn nor spring applications of potassium nitrate or urea increased leaf nitrogen concentration or tree growth significantly, although in one experiment the sprays delayed the onset of leaf senescence. By comparison, an autumn soil application of ammonium nitrate significantly increased leaf nitrogen concentration, terminal shoot growth and trunk circumference. It has been concluded that the commercial practice of using low concentration (0.6 per cent) potassium nitrate foliar sprays on peach trees has no influence on tree nitrogen status or growth.

Concurrent laboratory investigations demonstrated that the leaves of stone fruit trees were able to metabolize nitrate ions. Nitrate reductase enzyme, which is only present in tissue actively metabolizing nitrate ions, was isolated from the leaves of apricot, sweet cherry, sour cherry and plum trees. The trees were growing in sand culture and supplied with a nutrient solution containing excess nitrate ions. The enzyme was also isolated from detached leaves supplied with nitrate ions via the petiole. However, when nitrate ions were supplied to leaves via the cuticle, the amount of enzyme produced was greatly reduced. Partial removal or disruption of the surface waxes of the leaf prior to foliar absorption doubled the amount of enzyme formed. It is concluded that the poor response to potassium nitrate sprays in the field is associated with poor foliar absorption. One explanation of this phenomenon might be that surface waxes are limiting cuticular penetration by nitrate ions.

Leaf nutrient concentration standards for stone fruit trees. — The sampling procedures and standards developed for peach trees in the Murrumbidgee Irrigation Area between 1965 and 1967 were published.

The survey of above-average production orchards (reference orchards) on which the standards are based, was extended. Crops now surveyed are peach, apricot and prune on the M.I.A.; peach, sweet cherry and prune on the tablelands and peach and Japanese plum on the coast.

As a result of the extension of the survey, tentative standards have been prepared for apricot, sweet cherry, prune and plum. The standards will now be tested.

A continuing problem with the standards for peach trees is determining the extract break-point between "below normal" and "normal" for nitrogen, phosphorus and potassium. This is particularly so with respect to fruit quality. A factorial fertilizer trial was established on a block of Halehaven peach trees at Campbelltown which were found to be "below normal" in nitrogen, phosphorus and potassium in this year's survey. The trees are 10 years old. There are four nitrogen, two phosphorus and two potassium treatments, applied in mid-winter.

Leaf sampling procedures.— Studies of leaf-sampling procedures for peach trees have shown that sampling need not be restricted to fruit-bearing shoots and that leaf washing is only necessary where iron is to be determined. However, failure to refrigerate samples during transfer to the laboratory could result in increases in macro-nutrient concentration of up to 6 per cent. Sampling should be confined to January.

Residual Effects of Fertilizers on Nutrients in Banana Leaves

When fertilizer is applied to a crop it normally affects leaf nutrient concentration. With bananas, minerals are transferred from the parent plant to the new sucker. The effect of fertilizer applied to a parent plant should to some extent be reflected in the sucker and this will influence apparent residual effects of fertilizer treatments.

Residual effects of fertilizers on banana leaf nutrients were assessed in a nutrition trial block at the Tropical Fruit Research Station, Alstonville. A 3 x 3 factorial NPK trial had been conducted in the block from December, 1962 to December, 1967. The third leaf of medium-sized suckers was sampled and analysed for nitrogen, phosphorus, potassium, calcium, magnesium, manganese, zinc and copper, 10 and 26 months after fertilizer application ceased.

In the samples taken at 10 months, calcium and magnesium concentrations were depressed in plants which had received potassium. Leaf nitrogen and phosphorus were affected by a significant nitrogen x phosphorus interaction. The second sample, 16 months after the first, showed no significant effects of the fertilizer on any nutrient except manganese.

Nitrogen Fertilizer and Chemical Composition of Plants

Oats.— Nitrate levels were studied in a trial of nitrogen fertilizer on oats in the Riverina. Herbage nitrate content increased with the amount of nitrogen fertilizer applied and was at a peak in June, corresponding with a large temperature drop. The peak nitrate levels reached in the experiment could be lethal to grazing animals.

Kikuyu grass.— Samples of kikuyu grass from a trial at Wollongbar Agricultural Research Station was analysed. Nitrogen applications increased soil acidity which decreased the availability of molybdenum. This was shown in the concentration in leaves. Nitrate in the leaves also increased. At the highest rate of nitrogen fertilizer the nitrate reached toxic levels.

Lime applications increased soil pH, availability and concentration of molybdenum in leaves and concentration of nitrate in leaves. Phosphorus applications decreased molybdenum in leaves. There was a large dry matter response to high nitrogen and high phosphorus.

Soil Problems

Aluminium toxicity.— Aluminium toxicity has been studied in the chemistry branch for the last three years. A survey of a number of acid soils from the high rainfall areas of New South Wales showed that a high proportion of them contained levels of aluminium that were toxic to lucerne under glasshouse conditions. The studies are now being extended to the field, particularly on acid soils in the central tablelands.

In a preliminary survey 42 soil samples were collected from acid areas; six contained very high aluminium concentration. A computer programme was written for calculation of activity of aluminium, solubility of gypsum and activity of calcium, sodium and potassium.

The growth responses of five pasture species to lime, superphosphate and nitrogen were compared in a field experiment near Gundaroo in the Yass River valley on the southern tablelands of New South Wales, on a soil with a pH of 4.9 — 5.4. The soil had a high phosphorus requirement.

Lucerne was one of the least productive species at most harvests. It required more superphosphate than subterranean clover, perennial ryegrass or white clover to attain any given percentage of maximum yield. The visual symptoms on the plants and the yield interactions showed

little evidence of effects of high aluminium, which indicated that the superphosphate was needed to correct phosphorus deficiency rather than to counteract any aluminium toxicity. The initial soil pH was somewhat higher than the levels previously found to be associated with aluminium toxicity on the soil in pots.

Analysis Under the Fertilizer Act

A chemist was appointed to carry out work in relation to the Fertilizer Act, including development of methods and analysis of samples submitted under the Act. A new method was developed to analyse for nitrogen, phosphorus and potash on the one extract. The method is as accurate as the standard A.O.A.C. procedure but much faster. Whilst the work under the Fertilizer Act has priority, it has been possible to improve service to extension officers by analysing fertiliser samples such as those affected by rain or flood damage.

Rain and Flood-Damaged Superphosphate

Requests for analysis of fertilizer samples increased following flood rains in late summer. Many of the samples were of superphosphate that had been affected by rain or flood.

One effect of weathering on open superphosphate dumps was that soluble phosphates were leached down the dump and either accumulated lower in the dump or were lost entirely. The other effect was that the increase in moisture content resulted in a lower phosphate content per unit weight. As the moisture content of superphosphate increased from an average normal 6 per cent figure to 20 per cent, the phosphate content decreased from 22 per cent to 18.7 per cent.

Implementation of Amendments to the Fertilizer Act

Draft regulations were prepared to implement provisions of the Fertilizer Amendment Act of 1967. The main purposes of the amendments are:

- To introduce elemental expression of all nutrients in fertilizer analyses for labelling, registration and other provisions of the Fertilizer Act.
- To require invoice certificates and labels on fertilizer bags to show the content of ingredients additional to nitrogen, phosphorus and potash, namely calcium, sulphur, trace elements or pesticides where such fertilizers are sold "as containing" any of these substances.
- To show on the invoice certificate, labels, etc., the biuret content of the fertilizer.
- To prohibit the sale of any fertilizer containing more than 3.0 per cent biuret.
- To require the invoice certificate and label to show the fineness (i.e. percentage passing a 60 mesh sieve) of any *added* sulphur, lime, dolomite or magnesite claimed to be present in the fertilizer.
- To prohibit the sale of any substance as lime, dolomite or magnesite where such substance contains less than prescribed minimum amounts of calcium and magnesium. Similar minimum standards apply to lime, dolomite or magnesite where they are included in a fertilizer if the fertilizer is sold "as containing" lime, dolomite etc.

All fertilizer companies selling fertilizers in this state were informed of the provisions of the new regulations in order that they might comment and have time to prepare for the changes which will commence in January, 1972. To avoid confusion, a programme of public education will be necessary, particularly in relation to the change from P_2O_5 and K_2O to elemental expression of analyses.

SOILS SECTION

Soil Survey

Field work for the soil survey of the mid Clarence Valley was completed and preparation of the reports begun. A large amount of data was recorded and new concepts of terrain evaluation, stratomorphic pedogenesis and classification were employed. There will be a number of reports, varying in amount of detail and technicality, to cover all aspects of the survey and to meet differing interests of readers.

A soil survey of Grafton Agricultural Research Station was undertaken, mainly to assess the nature of the soils in the recently acquired areas. Students from University of Sydney and some officers from the Institute were trained in survey techniques, pedogenesis and classification during this survey. Field work was completed and the report and accompanying maps are being prepared.

A soil survey of the C. B. Alexander College, "Tocal" at Paterson was started. It also included training for staff of the soil survey unit.

Soil Advisory Service

Some 4,210 soil samples were analysed and reported upon in 702 soil reports during the year, representing little change from last year in total numbers. The long delays in reporting on samples which was causing concern last year, are being overcome now that additional staff have been appointed.

Manganese Toxicity

Alstonville:— New trials were begun in the manganese toxicity project at Alstonville. The project was widened to include study of the status and role of aluminium in these red basaltic soils.

In one trial, aluminium sulphate was used to acidify the soil and a number of rates of superphosphate, lime and magnesium carbonate were applied. In another, aluminium sulphate was applied to study the main effects of aluminium. Only one crop of the test plant, beans, was grown.

The beans were retarded and sickly in most plots. They were obviously affected by aluminium toxicity. However no pronounced symptoms of manganese toxicity were present. The worst affected plots were those on which no phosphorus was applied and plots without phosphorus were very poor even when they had received lime or magnesium to correct manganese or aluminium toxicity. Despite the lack of pronounced symptoms of manganese toxicity it was found that aluminium sulphate lowered pH and sharply increased manganese concentration in the soil.

The initial high aluminium content of some red basaltic soils inhibits normal growth of legumes unless phosphorus is applied. Addition of aluminium sulphate in these trials aggravated aluminium toxicity causing it to overshadow manganese toxicity.

Albury and Goulburn: — In a joint project with the plant nutrition section five lime trials are being used to study manganese toxicity in subterranean clover and lucerne in the Albury district. In these trials there has been a good response to lime. They have also demonstrated the effect of exposure of the soil to heat and, in some cases, the effect of water-logging in raising soil manganese to toxic level.

Soil manganese levels were not reduced immediately by application of lime even though the pH of the soil had risen. Soil manganese levels were found to vary from one sampling to the next.

Woogenellup subterranean clover showed adverse effects due to manganese in early autumn at Albury.

The behaviour of subterranean clover and lucerne under varying conditions of heat and water-logging are being studied in the glasshouse, using soils from improved and unimproved pastures in the Albury and Goulburn districts. Results so far show that even the more tolerant subterranean clover species could be adversely affected by manganese in some soils from Albury and Goulburn if the pasture is exposed to extreme heat or to water-logging.

Soil Physics Investigation

An existing laboratory was renovated for soil physics work, for which little laboratory space had been available previously.

An investigation of irrigation soils from Condobolin was started. These soils have proved difficult to flood irrigate because of characteristically poor penetration of water after the initial irrigation due to crusting of the surface soil. The soils were examined *in situ* and samples were studied at Rydalmere.

Laboratory tests have been aimed at determining the nature of, and possible remedy for, the surface crusting. They have included an examination of the soils' behaviour when quickly and slowly wetted and of the cohesiveness of aggregates of the soils when immersed in water. Soils from apparently unaffected areas, supporting good pasture growth, have a more stable structure than those from crusted areas. Some of the latter soils are quite stable to slow wetting, whilst being unstable to quick wetting, which suggests that a form of irrigation which does not flood the soil would be more suitable for these soils. However, some other soils appear to be totally unsuited to irrigation of any type.

Further work on this project is being directed to the possibility of predicting a soil's suitability for irrigation.

Phosphorus Investigations — Wheat

Central west. — Analyses of soil and plant material from wheat fertilizer experiments in the central west continued. The Chemistry Branch is co-operating with the Division of Plant Industry and the Biometrical Branch in this very large project supported by the Wheat Industry Research Committee of New South Wales. A total of 4,500 determinations were carried out for protein and phosphorus content of the grain and measures of available phosphorus in the soil.

Mainly because moisture was not a limiting factor in the plant root zone, the phosphorus applied to the soil was utilized much more efficiently than has been the case in many of the seasons since the project commenced in 1965. As a result, correlations between soil test levels and crop response to superphosphate were superior to those of previous years which could only be described as poor. All eight of the soil methods tested performed reasonably satisfactorily. Correlation coefficients with relative yield ranged from 0.729 to 0.817. The Egner Lactate test had the highest correlation. Coefficients with absolute yield were negative. They ranged from - 0.620 to 0.736 (Bray No. 2).

Grain of the variety Eagle was analysed from trials by the research agronomist at Condobolin in which the effects on yield and protein content of different rates and times of application of ammonium nitrate were compared. Protein content increased with increasing fertilizer rate but decreased when application of fertilizer was postponed until six weeks and twelve weeks after sowing.

Phosphorus Investigations — Pastures

Central and southern tablelands.— A new project was begun to improve advice to graziers from soil phosphorus tests. The question of how much phosphorus fertilizer to apply is important to graziers. It is wasteful to apply too much or too little. The aims are to determine: the economic soil phosphorus test level for a particular soil type, that is the optimum level beyond which further applications are uneconomic; the amounts of superphosphate needed to raise soil phosphorus to the optimum level; and the maintenance application required to keep phosphate at the optimum level for pasture production.

The project is supported by an Australian Wool Board Grant

A total of 17 sites in the Goulburn, Bathurst and Orange districts were fenced, cultivated and sown to a grass-clover mixture. All trials, except the seven in the Goulburn district, received their initial rates of superphosphate (Nil, 2, 4 and 6 cwt/acre) which will be followed at annual intervals with maintenance dressings of nil, 1, 2 and 3 cwt in a factorial design. Composite soil samples were taken from each individual treatment plot just prior to fertilizing and analysed for available phosphorus content. Sampling will be repeated annually.

A further 10 similar trials, continued in collaboration with the research agronomists at Berry, Taree and Glen Innes.

Condobolin.— At Condobolin Agricultural Research Station, soil phosphorus levels were monitored for an experiment on rates of stocking x rates of superphosphate.

Grafton.— For the project, fertilizer requirements for pasture production on north coast soils, 7,500 are being analysed for calcium, potassium, chlorine, sulphur, phosphorus and magnesium content on the X-ray spectrograph. The data will be correlated with soil phosphorus test figures from the 27 trials involved. This project is supported by the Australian Meat Research Committee.

Nitrogen Tests on Wheat Soils

Analyses of soils from the phosphorus x nitrogen trials on wheat in the central west proceeded. The results will be statistically related to grain yields.

Trials were sown in May to July, 1970: 10 in the Condobolin district, 8 in the Cowra district and 23 in the Trangie district.

Mineral nitrogen (ammonia and nitrate forms) and total nitrogen were determined on all soils. Anaerobic and aerobic incubations for potentially available nitrogen were applied to soils from the 1968 trials and some soils from the 1969 trials. Moisture characteristics for soils from the 1969 trials were determined. It is possible that the proportion of clay has an influence on soil nitrogen.

There was a general but not close relationship between the forms and levels of nitrogen in the soil and grain yield. Similar relationships have been obtained in previous years. These results indicate that climate should be taken into account in attempting to forecast the response of wheat crops to nitrogen fertilizers. Contact is being maintained with research workers who are studying the effects of the climatic variables.

Experimental sites were classified as response sites or no response sites and related to total mineral nitrogen (TMN) values at 0–3 inch depth. The results were: TMN of 0–10 lb/acre, 8 response sites and 5 no response sites at Trainge and 4 response and 4 no response sites at Condobolin; TMN of 10–30 lb/acre, 1 response and 3 no response sites at Trainge and 0 response and 1 no response site at Condobolin. Average TMN for response sites was 6.3 at Trainge and 4.6 at Condobolin. For no response sites it was 12.1 at Trainge and 6.2 at Condobolin.

Carbon:nitrogen ratios were also examined in these trials. No relationships were discernible.

X-ray Diffractometer

Several hundred soils are being investigated following the appointment of staff to operate the X-ray diffractometer and the completion of repairs and alterations to the powder camera. The Soils Division of CSIRO assisted by careful checking and aligning of the cameras.

While the equipment was in use, more work remained to be done to calibrate the powder cameras and to calibrate the X-ray spectrograph for potassium and exchange capacity determinations. It will be necessary also to prepare and record on photograph and plate, a number of standard clay samples and mixtures to permit approximate quantitative estimation of clay types in the samples.

Soil Potassium

New approach to soil potassium tests.— A new approach has been adopted to soil testing for potassium. Two fractions of soil potassium will be calibrated for their availability to plants in an endeavour to equate soil supply to crop requirement. The new approach followed repeated failures to obtain correlations between soil tests and responses, due to climatic and other factors, and conclusions from an overseas visit. Results of a large number of long-term trials completed in the last two years are being assessed with this approach.

Economics of potassium fertilizers.— Two groups of trials are in progress on the economics of using potassium fertilizers on pastures. On present evidence use of potassium fertilizers on pastures appears rarely justified under present economic conditions, pasture production methods and systems of management.

It would appear to be justified in areas where soils are initially extremely poor, for example sandstone country, and then as initial dressings only, or in areas where higher production than normal is possible, associated with intensive strip grazing, dairying or hay removal. Such high production is normal only where rainfall is high and reliable or where irrigation is practised.

Other potassium trials.— The trials referred to earlier under the heading “phosphorus investigations — pastures”, and supported by the Australian Wool Board, include potassium fertilizer treatments.

Potassium trials continued in co-operation with research agronomists at Taree, Glen Innes and Berry at 15 sites.

CHEMISTRY LABORATORY, YANCO

Rice Quality

Until February, 1971, the rice chemist was at Rydalmere. During this period modification of the International Rice Research Institute method for amylose determination was developed using dimethylsulphoxide (DMSO) as the starch solvent, eliminating problems of starch retrogradation previously experienced. Results from this method have shown much greater internal consistency than was previously possible. Other work at Rydalmere is reported by the cereal chemistry section.

Since commencing duty at Yanco a large proportion of time has been devoted to analysing a backlog of the plant material samples for nitrogen content, particularly in relation to grain-straw ratios and the weeds trials. This work has been completed.

Limited oil seed analysis was carried out in co-operation with agronomists in the South Western Region. Soybeans from Leeton and Yanco Agricultural Research Stations and sunflowers from Leeton Agricultural Research Station were analysed for protein. Oil determinations of these samples are proceeding.

Soils

The chemist working on rice soils resigned in May. The extensive work previously undertaken on the role of nitrogen in rice soils is described in the report of the Division of Plant Industry.

DAIRY CHEMISTRY AT HAWKESBURY AGRICULTURAL COLLEGE

The dairy chemist resigned early in the year. Before his departure he continued the survey of chemical composition of local cheese and the project on the relationship between chemical composition and cheese-grading of export quality cheese.

CHEMISTRY LABORATORY, WOLLONGBAR

The new Regional Research Laboratory at Wollongbar was ready for occupation in December, 1970. Two graduate officers of the Chemistry Branch are now stationed at Wollongbar. They are engaged in joint projects with other research workers, supply chemical services for research on the Station and undertake some individual research projects.

Maturity Testing of Avocados

Maturity indices for avocados on the north coast of N.S.W. are being investigated. Suitable indices have been selected for study after literature survey and field visits. Some of the equipment needed has arrived. Using a manual technique, some approximate values for oil content have been obtained, mainly as a service to local industry through fruit officers. Oil content is a likely index of maturity.

The second aspect of maturity work, taste panel testing, has commenced and a panel has been selected from local research officers after preliminary tests and surveys. Taste panel testing was discussed with officers of the CSIRO Division of Food Preservation.

Associated studies on avocados include production of growth curves on whole fruits in co-operation with officers at the Tropical Fruit Research Station.

Vitamin and Mineral Nutrition of Pigs

The response of pigs to vitamin and mineral supplements in diets commonly used in N.S.W. and the main interactions of minerals and vitamins with other factors such as feeding rate are being studied. The work is intended to lead to a survey of vitamins and minerals in N.S.W. feedstuffs.

Mineral assays of diets in current trials are being carried out. Samples have also been analysed for crude protein and dry matter. Vitamin analysis is new to Wollongbar so it has been necessary to acquire experience as well as chemicals and equipment.

Insecticide Residues in Dairy Cattle

The study of insecticide residues in cattle resulting from grazing treated pasture is described in the pesticides section of this report. One of the chemists at Wollongbar has a major role in the study.

Long-term Effects of Nitrogen Fertilizer on Soil Fertility and Plant Growth

The long-term effects, including adverse effects, of heavy applications of ammonium sulphate to kikuyu are being studied. The use of phosphorus and lime as corrective measures for adverse effects is being evaluated and the use of less harmful forms and rates of nitrogen is being assessed.

The project was started in 1969. Frequent collection and analysis of plant and soil samples are intended to define the reasons for plant responses and the most efficient time for fertilizer application.

Nutrient Requirement of Grazed Naturalized Grass Pasture

The aim of this experiment is to determine the effect of different levels of nitrogen fertilizer and stocking rate on the optimum nitrogen requirement of kikuyu, paspalum and carpet grass and on the mineral content of pasture herbage. Pasture samples are being analysed for total nitrogen, phosphorus, potassium, calcium, magnesium and sulphur.

Tropical Components of Feed Year Grazing Trial

Neutral detergent fibre analysis, nitrogen analysis and in-vitro digestibility determination are being undertaken as part of this project. Mineral composition of local pastures is also being assessed.

Chemical Services

In addition to the projects reported individually, chemists at Wollongbar provided analytical services for other research projects at the Station and for some at Grafton Agricultural Research Station. About 7,000 analyses were completed. The chemists were also engaged in acquiring and preparing equipment and facilities for future chemical studies.

DECENTRALISED AGRICULTURAL RESEARCH DIRECTORATES

AGRICULTURAL RESEARCH INSTITUTE, WAGGA WAGGA

WHEAT IMPROVEMENT

Yield Trials

A wet spring led to above average yields and tended to favour later maturing varieties at all trial sites in 1970. In the central areas the wet spring followed a severe winter drought, but at Wagga there was little winter stress. However the excessive spring rains induced an epidemic of *Septoria tritici* which markedly affected yield results. Damage from stem rust was negligible.

Line M1224-2.— At both Wagga and Temora the line M1224-2 again proved to be resistant to *Septoria*, giving top yields in all but one trial where it was equalled by the new Tasmanian variety Isis, which also has some resistance to this disease. It is markedly superior to Olympic in straw strength and ease of threshing and similar in baking quality and grain protein content. Over all trials the yield has averaged the same as Olympic and in good seasons it has been distinctly better. M1224-2 is being seed-increased on Research Stations in anticipation of release in 1973.

Crossbred M1313.— The soft grained winter crossbred M1313 again performed well. In a March sown grazing trial it provided less green forage (86 per cent) but more in grain recovery (147 per cent) than Cooba oats. The results indicate that M1313 should be suitable for the dual purposes of grazing and grain.

Eagle.— The newly recommended Eagle was a little disappointing in yield. However it lodged less than Falcon, its recurrent parent, and unlike many lines its bushel weight and quality remained good under all conditions experienced. There has been a strong demand for seed of Eagle from registered seed growers and the variety has been accepted with Falcon as the basis for a Hard Wheat classification in the southern wheat belt. Although the semi-dwarf stem rust resistant derivative of Falcon (designated DARF PA 134-2) only equalled Eagle at Wagga and Temora it performed well in the national trials in Western and South Australia. The line is considered to be an advance on Eagle and Falcon in milling and baking quality as well as in yield and resistance to lodging.

Derivatives of semi-dwarf Mexican wheat.— By far the most promising material in the Wagga programme are the white grained derivatives of the early semi-dwarf Mexican wheat referred to in previous reports at WW15. Some 25 of these, consisting of single backcrosses to WW15, were sown in replicated preliminary trials at three sites in New South Wales and at several locations in Queensland. There is little doubt that the remarkable yield of WW15 has been recovered, if not slightly exceeded in some lines. There was also a range in rust resistance, milling quality, grain protein content and baking quality. One selection 69-7147 is in a bulk seed increase of 20 acres during the present season. A white grained mutant of WW15 has been obtained following treatment with the chemical EMS.

Biscuit wheats.— Two soft grained derivatives of WW15 from a cross with Heron are being examined for biscuit wheat production in the irrigation areas. The standard biscuit wheat, Pinnacle, was severely damaged by stem rust in the Coleambally Irrigation Area in 1970 and a great deal of attention is being directed to the selection of a replacement. An extensive backcrossing programme, based on Pinnacle, was carried forward a further stage.

Central West.— Testing of varieties was continued in the Central West to ascertain the place in this region of new varieties derived from the northern and southern breeding programmes.

Hybrid Wheat

Studies of hybrid wheat have been continued. In the 1970 season the first yield trial compared the hybrid Heron x Dirk with the parent lines. The hybrid had slightly greater yield than the parents but it became clear that future hybrid wheat studies would need to be based on semi-dwarf parents. Previous difficulties in the pollination of male sterile lines in the field again occurred; the seed set of male sterile Heron surrounded by a large area of Heron was approximately 50 per cent.



Dr A. T. Pugsley (left), Director of the Agricultural Research Institute, Wagga Wagga, and Dr N. E. Borlaug, Nobel Prize winner and Director of the Wheat Programme, International Maize and Wheat Improvement Centre, Mexico. Dr Pugsley and the Institute were each awarded medals issued to commemorate the contribution of Mexican wheats to the fight against hunger. The awards were in recognition of the co-operation of the Australian research workers in the International Centre's programme.

Genetics of growth habit

A long-term study of the inheritance of growth habit involving a range of varieties varying in responsiveness to vernalization was carried through to the publication stage. This study has confirmed and extended previous work undertaken in Sweden and Japan and has led to the identification of varieties carrying dominant genes inhibiting winter habit designated S_k and S_s . Evidence has also been secured for the existence of a third inhibitor S_1 carried by the varieties Loro and Chinese Spring.

Field studies have led to the formulation of a scheme for describing the characteristics of wheat varieties relating to their phasic development. Useful selection techniques have been developed which are now being applied to the southern wheat breeding programme.

During the next five years several semi-dwarf lines of winter habit will be examined and if the results are favourable the replacement of all spring varieties by winter habit types will be considered.

WHEAT QUALITY INVESTIGATIONS

Quality Evaluation

Apart from routine quality evaluation work with advanced crossbreds, attention has been devoted to further development of micro milling, baking and physical dough-testing techniques and their application in the screening of early generation material.

Intensive investigation of a number of variables associated with micro milling and particularly in grading and preparation of the samples for milling has overcome former difficulties and led to a procedure which gives results in close agreement with those obtained by macro laboratory methods. This development has permitted, for the first time, effective screening of early generation lines of wheat on the basis of wheat on the basis of their milling quality.

The Institute already has two advanced crossbred wheats — one soft and one hard — with excellent milling quality and, with these as reference standards, heavy discarding has again been made for milling quality. Reduction of the number of lines proceeding to subsequent micro baking and physical dough-testing has greatly increased the capacity of the micro testing unit.

Following establishment of soft biscuit wheat requirements in terms of the Institute's micro Extensograph technique, all soft wheats have been screened for suitability in this class. Hard wheats are screened for breadmaking qualities by means of the now well established micro baking test.

The Institute's effort over the years in raising the quality of southern wheats has been acknowledged in the acceptance of Falcon and Eagle as the basis of the new quality segregation scheme in southern N.S.W.

The more basic study of the relationship between some micro Extensogram characteristics and the oxidation status of doughs from routine micro baking tests has met with some difficulties which still need elucidation before fine differentiation of maturity can be made. Despite this, the technique is a very useful addition to early prediction methods already in use by wheat quality laboratories. It provides a rapid and effective means of detecting "overstability" in bread wheats and of identifying potential biscuit wheats amongst soft wheats. The ease and speed of testing relative to that of the standard macro method would probably appeal also to industry. Details of the micro Extensograph technique are now being prepared for publication.

Silo protein study

Multiple regression techniques were used in an effort to understand the influence of climatic factors on grain protein levels in Culcairn, Hume, Lockhart and Urana shires. Almost 77 per cent of the variation in silo protein levels over the period 1948/49 to 1968/69 was explained by changes in sowing time, May to July rainfall and August to November rainfall. Nearly 86 per cent of the protein variation was accounted for by variation in May to July rainfall, August to November rainfall, and a time trend factor thought to be associated with the extension of clover ley farming in the region.

OAT IMPROVEMENT

The 1970 season was favourable for testing oats both for grazing and grain purposes. Heavy frosts with temperatures of 21⁰, and 24⁰ F, on successive days in mid-July killed approximately 60 per cent of plants of the early sown grazing trial. The frosts occurred immediately after the trial had been grazed down to ground level. Heavy rains coupled with gusty winds prior to harvest resulted in severe lodging, particularly in the ungrazed trials.

The highlight of the year was the outstanding performance of Cokers x Osage² (M1341), confirming good results over the past four years. It has a great potential as an all purpose oat variety. The crossbreds Avon x Fulmark x Coolabah (M1359) and Swan x Cooba (M1363) again showed promise. However, because of their weak straw, the two Victorgrain x Fulmark² derivatives (M1354 and M1353) were disappointing in grain yields.

The popularity of Cooba increased still further and it now occupies 35.2 per cent of the New South Wales acreage. Its extremely low husk percentage has certainly contributed to the great popularity of this variety and led to its acceptance for milling purposes despite its low 1,000 grain weight of approximately 37 grammes. Swan, with its extremely high grain weight (54 grammes) and a medium husk of 30 per cent, represents the best combination of these two characters so far achieved commercially. This combination has been sought in F4 and F5 progenies during the last two years and promising material has been selected.

WEEDS AND WEED CONTROL

Skeleton weed (Chondrilla juncea)

Studies on the embryogeny of skeleton weed indicated an erratic initiation of the endosperm. A multinucleate endosperm was often apparent in the early stages of embryo development but the cellular stage usually was not observed until the embryo was well advanced. Early subricization of the endothelium, associated with a well developed cellular endosperm and an aborted embryo, suggests that integumentary nutrition may be an important factor in embryo development.

Paterson's Curse (Echium lycopsis)

Survey.— A survey of Paterson's Curse in the south of the Southern Agricultural Region showed a general very light infestation. Major infestations with ground cover varying from 10 to 40 per cent and reaching 100 per cent within individual paddocks, were observed in the Oura-Wantabadgery, Kyeamba, Westby-Noonbah and Murray Valley areas. An especially heavy infestation was present in the Wantagong-Moombril region near Holbrook. Occasional roadside patches in timbered areas indicated the presence of seed and potential infestations should clearing take place.

Herbicides.— The response of Paterson's Curse to 2,4-D and to several new herbicides and herbicide mixtures was examined. Preliminary results showed that the currently recommended method, (2,4-d ester applied to seedling Paterson's Curse at 6 oz a.i. an acre) gives 95 to 100 per cent control, especially where sprayed areas are grazed with sheep one to two weeks after spray application. The amine salt of 2,4-D at 3/4 to 1 lb an acre gave similar results. Although early spray applications are the most economical, 2,4-D plus atrazine mixtures (2,4-Danine 1 lb a.i. + atrazine 4 to 8 oz a.i.) gave adequate control even when applied in the early flowering stages. Bromoxynil plus 2,4-D mixture also was promising.

Weed Control in Wheat

Preplanting applications of triallate 16 oz a.i., trifluralin 6 oz and 12 oz a.i., pre-emergence applications of diallate 12 oz a.i. and post-emergence application of dicuran at 40 oz a.i. an acre gave adequate control of wild oats (*Avena fatua* L.) and increased wheat yield significantly. Lower application rates and pre-emergence application of trifluralin and dicuran did not give adequate weed control. MSMA at 6 lb a.i. post-emergence reduced weed population and increased yield.

Weed Control in Lupins

Preliminary trials with early post-emergence application of simazine, fluometuron, carbetamide and dicuran applied at 2.67 lb/ac gave better than 90 per cent control of weeds without increasing grain yield. At 1.33 lb/ac weed populations were reduced by only 75 per cent but grain yield was doubled.

Weed Survey

The final survey in the current study of the effect of weeds on wheat yields in southern New South Wales was completed during 1970. At 34 representative sites yields of wheat from areas kept free of weeds by repeated hand weeding were compared with yields from adjacent weedy areas. On average, weeds present after sowing reduced dry matter yields at flowering by 12.9 per cent and grain yields by 16.4 per cent.

PLANT PATHOLOGY

Septoria leaf blotch of wheat

An extensive field trial was undertaken to study the effect of *Septoria tritici* on the growth and yield of Robin wheat. The disease was almost completely controlled by spraying 5 ft x 60 ft plots with dithane M-45 benlate. Plots sprayed with dithane M-45 yielded 64 bus/acre compared with the unsprayed plot yield of 40 bus/acre. Bushel weights were 61.5 and 57.1 lb respectively and 1,000 grain weights 38.5 and 29.3 grammes respectively. Results with benlate did not differ significantly from those with dithane M-45. Tests demonstrated that the chemicals in themselves had no effect on growth or yield components.

Net blotch of barley

A large scale field trial for the control of net blotch (*Pyrenophora teres*), variety Beecher demonstrated that this disease could be controlled with dithane M-45. Yields of 92 bush/acre were obtained from the sprayed plots and 68 bush/acre from those unsprayed. Bushel weights were 49.0 and 45.8 lb respectively. Similar spray treatments with benlate were quite ineffective.

PLANT PHYSIOLOGY

Crop Behaviour

Co-operative experiments between the Institute and Macquarie University on crop-climate relations, commenced in 1969, were continued in 1970. The aim of the project is to evaluate actual evapotranspiration in relation to climatic variables, crop growth and soil moisture potential. Crop parameters are varied by using two sowing densities, each with two times of sowing. Relevant climatic and soil data are recorded every ten minutes using a digital volt meter and paper tape punch. There have been prolonged delays in the installation of a weighing lysimeter which was to be used as a base measurement of evapotranspiration.

Efficiency of Water-use in Wheat

Work on this aspect of wheat physiology was continued. This year disturbing effects from infection with *Septoria tritici* were encountered and future work will need to involve its control. A preliminary experiment on the effect of the physical state of the soil water on growth was conducted. The results hold promise of assisting in the quantitative interpretation of the relation between wheat growth and soil water and the experiment is being repeated in an extended form.

PASTURE INVESTIGATIONS

Stocking Rates and Superphosphate

Investigations to determine the effect of sheep stocking rate and superphosphate topdressing on the productivity of grazed annual pasture began in 1962. Results suggested that satisfactory animal production could be maintained where stocking rate was increased and superphosphate level reduced. Production from unfertilized pasture increased substantially. Following the pasture phase, the experiment was taken to a cropping phase to determine effects on crop performance. This aspect is nearly finished.

The initial grazing study was undertaken on a soil of medium-to-low phosphate status and the grazing animals were merino wethers. Because soils in the region vary from low to high in phosphate and lamb production is the dominant sheep enterprise, the work was extended in 1969 to use breeding ewes and to account for different levels of soil phosphate, applied superphosphate, stocking rate and rainfall level. Results so far support the earlier work. Superphosphate has influenced grazed pasture yield and composition. Liveweight of animals has responded to topdressing during the pasture growth season but in the dry season unfertilized pasture has maintained live-weight more satisfactorily. Neither wool production nor lamb production has been substantially affected by superphosphate topdressing.

Management and Time of Lambing

The management and time of lambing experiment described in previous reports continued. Trends have been consistent. As stocking rate increased from 3.3 to 5 ewes an acre wool production per sheep has been reduced by approximately 10 per cent although production per acre has increased. Lower stocking rate treatments have produced more marketable mutton per head and just as much marketable mutton per acre as the high stocking rate treatments. The latter have had more culls available for sale or carryover.

Comparison of management systems continued to demonstrate the trend established from the beginning. Systems involving a fodder crop of oats, lucerne, or both, produced less wool or mutton per acre than simple set stocking. Set stocking treatments generally achieved the highest lamb growth rates, the best in 1970 being 0.79 lbs per day. The poorest, 0.44 lbs per day, was on a treatment with oats supplement. Set stocking treatments have also consistently produced the highest wool cuts per sheep. The autumn deferment pasture treatments have not differed from the set stocked treatments but seasons have been above average and this system of management is only likely to be useful in years in which germinating rains are late. There is a possibility of a response from this treatment in the 1971 season.

Pastures which were initially Wimmera ryegrass and Marrar subclover began to be invaded by different species reflecting the different management systems. Set stocking plots were the most resistant to invasion by other species. In plots with large areas of fodder crops sheep were concentrated on the subclover and ryegrass section of the plot while the fodder crop was being prepared or spelled. Concentration of animals on smaller portions of the plots resulted in more severe damage to the species present than occurred under set stocking. This damage to the subclover and ryegrass plants gave invading species the opportunity to become established. Silver grass became established under these conditions.

Lucerne

No new trends were established from the lucerne management experiment. More time will be needed before confident conclusions are possible. At present it appears that a three paddock system is adequate for maintaining a lucerne and annual grass-clover pasture at Wagga Wagga.

The species evaluation work has shown that advantages in sheep production appear to be associated with pastures which incorporate lucerne. Differences in animal performance between pasture types in each season appear to reflect the differences in herbage production of the phalaris, lucerne and wimmera rye-grass-subclover pastures being evaluated.

ANIMAL HUSBANDRY

A senior Research Officer was appointed to formulate and supervise animal husbandry research programmes. This new development is expected to increase the scope of the Institute's research with animals. A review of research needs has resulted in a number of projects being considered. Both industry funds and producer support have been sought.

In the higher rainfall area east of Wagga Wagga knowledge is sought concerning the use of superphosphate on pastures. An experiment was designed to determine animal productivity in relation to phosphate status of soils and its continued application at various levels. In the same area it is also planned to determine how the nutritive requirements of cattle and sheep can best be met on a whole farm, whole feed year basis.

Other projects suggested by the review of animal husbandry research needs are being considered. They include: new forms of production for traditional wheat and sheep properties; an evaluation of lupin seed as a component of pig and poultry rations; the utilization of grain for cattle and sheep feeding; and Angora goats as an alternative to sheep.

Extension of the Department's Sheep Fertility Service was planned and it is intended that a new unit will operate from the Institute.

CROP AGRONOMY, FERTILIZERS & SOIL CHEMISTRY

Rainfall.— Climatic conditions were favourable with above average rainfall. Autumn rains were adequate for sowing but were followed by relatively dry conditions in June and July. Heavy rain in August and September resulted in some flooding and further good rain in November extending into early December provided favourable conditions for weed growth and also resulted in a late harvest.

Soil Fertility Following Pastures

Following a seven-year period of grazing a large area of land was sown down to three successive wheat crops during 1967–71. Treatments were designed to evaluate the residual effect of superphosphate previously applied to the pasture.

In 1967, a drought year, wheat yields were low and there were no marked differences between treatments. Yields were high in 1968 and added nitrogen fertilizer depressed yields but less so in the second crop than the first. A third order interaction between superphosphate applied in the pasture phase, superphosphate applied with the wheat crop and nitrogen fertilizer was highly significant. In 1969 yields were intermediate and nitrogen increased yields more in the third crop than in the second and more in the second than in the first crop. There was a response to current superphosphate dressing on the wheat. The 1970 results are awaiting analysis.

Nitrogen Soil Tests

Investigations into the feasibility of using nitrogen soil tests for wheat production in southern New South Wales were continued.

Results from a further 171 simple nitrogen experiments became available during 1970/71, the last of four years allotted to the broad assessment of the nitrogen status of wheat soils in southern New South Wales. Over the entire programme, paddock history, soil nitrogen and phosphorus soil tests, cultural data, grain yield and protein results (with and without applied nitrogen fertilizer) and monthly rainfall information have been obtained from 897 sites. In 1970 there was again a general correlation between absolute yield levels and yield responses to 30 lb an acre of nitrogen (broadcast as ammonium nitrate shortly after sowing) on the one hand and the three tentative soil nitrogen classes based on chemical tests on the other.

Average absolute yield levels were 26.6, 32.2 and 37.9 bushels an acre in the low, medium and high soil nitrogen classes respectively. Average yield responses were 7.4, 5.6 and 1.2 bushels an acre in the same three classes respectively. For the first time in four years, average absolute yields with and without nitrogen fertilizer were higher in the western part of the study area.

Now that four years of field and laboratory data have been assembled, it remains for the various soil tests to be assessed singly and in combination. The significance of other variables, particularly agronomic and climatic ones, in determining the responsiveness of wheat to nitrogen fertilizer will also have to be considered.

*Trials for the Calibration of Laboratory
Techniques of Soil Phosphorus Determination*

Superphosphate (22 per cent) was drilled with Heron wheat at 0, 50, 100, 200 and 400 lbs an acre on ten sites. Two sites were eventually abandoned due to water-logging and weeds, the remaining eight were successfully harvested. The accuracy of the recommended rate decided by the soil test compared with actual results was good in five trials, moderate in two and bad in one.

Method of Application and Form of Nitrogen on Wheat

Trials were established at Junee and Ladysmith to investigate the behaviour of three forms of nitrogen on wheat. Superphosphate (22 per cent) at 100 lb an acre was drilled with Heron wheat. Sulphate of ammonia, urea and ammonium nitrate were both drilled and top dressed at rates of 0, 20, 30 and 40 lb N an acre. In both trials nitrogen gave a significant increase in yield over no nitrogen. In one, urea drilled at 60 lb N an acre depressed yield, otherwise neither method was superior. In both trials there was a significant increase in yield due to form of nitrogen, but in one case this was due to urea, and in the other to sulphate of ammonia.

Time of Sowing and Time of Application of Nitrogen

Ammonium nitrate at 0, 15, 30 and 60 lb N/acre was top-dressed at sowing, at the 5 to 6 leaf stage and at the "in-boot" stage on Falcon wheat sown in mid-May and mid-June at Wagga and Yerong Creek. 150 lb an acre of 22 per cent superphosphate was drilled with the seed. In both trials the later sowing gave a significant increase in yield. No other treatment effects were significant at Yerong Creek, but at Wagga nitrogen rate and time of application were significant and there was an interaction effect. Nitrogen increased yield when applied at sowing and at the 5 to 6 stage but not at the in-boot stage.

Time of Sowing and Rates of Phosphorus

Falcon wheat was sown in mid-May and mid-June at Wagga and Yerong Creek with 22 per cent superphosphate at rates of 0, 75, 150 and 300 lb an acre. Plots were split and 30 lb nitrogen an acre as ammonium nitrate was applied at the in-boot stage. At Wagga the nitrogen application increased yield significantly; there was no other effect. At Yerong Creek late sowing was significantly more productive than early sowing and succeeding rates of phosphorus increased grain yield.

Rates of Nitrogen and Phosphorus

Falcon wheat was drilled with 22 per cent superphosphate at rates of 0, 75, 150 and 300 lb an acre at Wagga and Yerong Creek. Nitrogen as ammonium nitrate was top dressed at rates of 0, 15, 30 and 60 lb an acre. Plots were split and a further 30 lb of nitrogen was applied at the in-boot stage. At Wagga yield was increased by nitrogen applied at sowing and further increased by the application at the in-boot stage; there were no other effects. At Yerong Creek yield increased with succeeding rates of superphosphate.

Continuous Cropping

Five field trials were harvested for the 1970 season. Two of these were so badly damaged by birds in their early stages that normal comparison between treatments was not possible. Two trials were seriously infested with wild oats but excellent control was obtained by spraying with barban. Indications are that the full potential of the no-tillage treatments is not yet being achieved and a small subsidiary trial is being prepared to investigate this.

A full range of treatments was applied at all sites in preparation for the next year's crop and some preliminary work done in evaluating suitable soil physical measurements.

Soil Phosphorus — Wheat

The Pilot Soil Testing Service for phosphorus on wheat completed its second year and statistical evaluations of results for years one and two (1969 and 1970) were almost completed. Results are summarized in the following tables:

Summary of 1969 results (statistically successful trials)

centre	Leeton	Wagga	Cootamundra	Albury	Total
No. trials harvested	17	46	39	46	148
No. statistically successful trials	14	27	32	23	96
Average rainfall (inches)	17.2	20.5	22.2	23.1	21.3
Average phosphate level (ppm available P)	23.3	27.6	23.9	25.1	25.3
Average pH	5.0	4.9	4.8	4.8	4.9
Average recommendation based on soil test (lb P per acre)	4.7	9.1	13.8	12.5	10.9

Summary of 1970 results (statistically successful trials)

centre	Leeton	Wagga	Cootamundra	Albury	Total
No. trials harvested	26	60	39	36	163
No. statistically successful trials	18	43	24	33	118
Average rainfall (inches)	16.5	20.0	21.7	22.7	20.6
Average phosphate level (ppm available P)	20.9	20.6	18.5	22.8	20.8
Average pH	5.0	4.7	4.6 *	4.6	4.7
Average recommendation based on soil test (lb P per acre)	6.3	15.7	18.1	17.6	15.3

Despite the experience of the co-operating farmers and use of a portable bin and scales to measure trial yields accurately, results for the second year were not an improvement over those of the first year.

When the value of wheat was set at \$1.10 a bushel and superphosphate at \$1.50 a 100 lb and the excess of profit over loss calculated it was found that more profit would have been made by following a soil test recommendation than by following the District Agronomists's recommendation in the Albury and Cootamundra districts. The reverse was the case for Leeton and Wagga districts. Over all, farmers would have profited by following the soil test recommendations. Profits from District Agronomists' recommendations varied only marginally from those of the soil test. When losses occurred they tended to be in the lower rainfall areas.

Trials for the current year have been sown by 144 farmers, only three of whom are co-operating for the first time.

Soil Phosphorus — Pastures

Economic considerations have caused many farmers to reduce or dispense with top dressings of superphosphate on pastures. In the short term there appears to be no drop in animal production but long term effects are being studied in the glasshouse, laboratory and the field. In particular the importance of organic phosphorus as a "soil P sink" is being studied together with the role of faeces in recycling phosphorus. Slowly available sources of phosphorus such as basic slag and rock phosphate are being studied in relation to the growth of subterranean clover.

Nitrogen Reactions in Soils

Non-exchangeable ammonium. — The programme to evaluate the importance of non-exchangeable ammonium in the nitrogen economy of the soils of the region has been concluded.

It has been shown that the non-exchangeable ammonium fraction of soil nitrogen is unlikely to be of economic significance in the farming soils of the region. Six soils were examined in laboratory and glasshouse trials, using three forms of nitrogen fertilizer. In only one soil was there significant ammonium fixation, and this soil represents only a small proportion of the total farming area in the region.

Inhibitors of nitrogen mineralization.— Studies to evaluate the possible use of these inhibitors have commenced in soils from the region. If they can slow down the mineralization of organic nitrogen compounds, built up over the clover ley period of the rotation, they may prove to be of economic value.

Growth regulators.— Evaluation of the effect of a phenyl compound on the utilization of nitrogen and phosphorus by various crops, including wheat, peas and rape continued. Overseas, this compound has been responsible for large increases in grain yields of a number of crops, such as wheat, oats and barley, without significant increases in dry matter production.

AGRICULTURAL RESEARCH DIRECTORATE, TAMWORTH STATION

AUSTRALIAN WHEAT COLLECTION

Considerable progress has been made in growing, storing and classifying the original 10,000 lines received when the collection was founded, and an additional 3,000 that have been received since. But much remains to be done. Meanwhile, the collection is being used by wheat workers all over Australia. They are taking vigorous advantage of the services of the collection in importing new varieties as well as using existing stock.

The 3,000 lines sown in 1970 were all under irrigation and, as a result, good yields and good samples were obtained in most cases. An appreciably larger sowing in 1971 was prevented by dry conditions and again about 3,000 lines were sown under irrigation — two-thirds were introductions to Australia either by the Australian Wheat Collection or by other centres in Australia. The remaining sowing included a further portion of the Afghanistan collection and some 500 lines of which a satisfactory sample was not obtained in previous years. A further 200 of the latter lines are being increased in the glasshouse, while about 600 of the least urgent are being held over till 1972 because of the dry conditions.

The quarantine glasshouse supplied by the Commonwealth Department of Health (Plant Quarantine) was occupied in August, 1970. Importation and quarantine of new lines continued at a high rate. Requests for seed from Australia and overseas continued to be fulfilled as received.

The record system of the collection is still far from complete. About 11,500 lines have been accessioned. A card index, both alphabetical and in shelf list order, has been made for the first 9,000 and a listing of the names for use of other centres has been made to the same point. Sheets have been printed for the final register of entries and the first 1,600 entered.

As a result of approaches made in October, 1970, during a visit to 4 states, 14 batches of 500 entries are being tested for a range of characters in 6 different centres. In addition, the University of Sydney has already tested 1,000 entries for rust resistance and has indicated its willingness to continue this work. When all the data are received and collated a start on automatic data processing may be justified.

WHEAT IMPROVEMENT

Durum Wheats

Yield trials.— Yield trials were again sown at five sites at North Star, Moree, Narrabri, and Tamworth. Duplicate sowings were made in early May and early June at Tamworth and Moree. Bird damage was severe at Moree, where yield trials provided seed for quality assessment only.

In all yield trials the early maturing lines outyielded both the bread wheat controls and Duramba.

Duramba.— Seed of the newly-released, semi-dwarf durum variety, Duramba, was increased; 30,000 bushels were harvested from 1,500 acres. This seed will be sown in 1971/72 under contract to the Premium Wheat Growers' Association and the harvest will be used as the basis for establishing an export market.

Grazing trial.— A trial to examine the grazing potential of Duramba was commenced last season. Results indicated that Duramba is as good as Dural for grazing.

Urea spray at flowering.— An experiment to determine if the protein content of Duramba could be raised by application of a urea spray at flowering gave no statistical increase in protein or yield.

Physiological development.— Preliminary investigation of the physiological development of Duramba and Dural gave indications that Duramba has a different control mechanism to Dural, and that the time to ear initiation is dramatically decreased by long days. Plants were sown on October 5, 1970. With a normal day, the days to ear initiation were: Gabo — 25; Timgalen — 24; Duramba — 21; and Dural — 30. With a 20 hour day, the days to ear initiation were: Gabo — 13; Timgalen — 13; Duramba — 8; and Dural — 26.

These investigations are continuing with sowings at selected times throughout the year to define the developmental patterns of Australian durums. Early lines 56,111/12a and 10,238/1 have also been included in the sowings.

Resistance to stem rust.— In a study to determine if non-specific resistance to stem rust exists in durums, selected varieties are being crossed in a complete diallele and the progeny will be rust tested. A search is also being made for any uncatalogued genes for specific resistance in the material being used. If resistances are found an effort will be made to transfer them to bread wheats.

Current trials.— Sowings of yield trials have been delayed this season except for two trials at North Star and Moree. However, all early generation material has been sown under irrigation. At Narrabri, a trial has been sown under irrigation to determine the effects of fertilizer and sowing rate on Duramba, and to determine the maximum yield when fertilizer and water are not limiting. The maximum treatment rates are 200 lb of urea and 149 lb of seed per acre.

Bread Wheats

Unfavourable season. — The 1970/71 season was not favourable for breeding work due to excessive rain at harvest. As a result, grain from many plots suffered weather damage, and severe lodging on heavy soils reduced the value of yield comparisons.

New crossbred No. 221.— Despite the season, it was possible to complete the yield and quality evaluation of the new crossbred No. 221. This crossbred is intended to replace Festiguay. It has resistance to stem rust, superior grain quality and high yields. Approximately 7,000 bushels of No. 221 were harvested, some of which was distributed to registered growers to ensure adequate supplies of seed for 1972 if required.

Quality.— For the first time milling and baking tests on all new material in yield trials were completed before sowing the 1971 crop, ensuring a high level of quality in all strains under test. This was possible because previous difficulties in staffing the cereal laboratory were overcome.

Frost resistance.— Most crosses made incorporated at least one parent of known resistance to frost. It is intended that all new strains coming to yield test in future will pass through a routine screening for this character, so completing the integration of the bread wheat programme with that of breeding for frost resistance.

Breeding for Frost Resistance

April sowings tested 36 fixed lines from the cross Afghan H996/Mexico 120/I.R.N.101/Cheyenne against local commercial varieties at Tamworth and Narrabri. Severe frosts in July caused up to 73 per cent loss of tillers in susceptible varieties, contrasting with 17 per cent to 32 per cent for the best resistant selections. These results confirmed laboratory tests undertaken in previous years.

Final grain yields did not clearly reflect frost effects due to heavy regrowth of tillers on frosted plants. However, significant varietal differences were recorded and it was encouraging to note that one family of selections from the frost resistant material out-yielded all other varieties and strains in two sowings. The best of these have been used extensively in crosses and will be further tested in the field. The effectiveness of the programme has been greatly improved by the provision of a specially-designed, temperature-controlled glass house. The glasshouse was financed by the Wheat Industry Research Committee and has proved most successful in growing uniform plants for frost testing.

To improve the understanding of selection techniques, preliminary studies were undertaken on the problem of supercooling in tissues. It was found that wheat plants differed markedly from those of some other species in that they super-cooled readily to temperatures in the range -8° to -10°C . By contrast peas, beans and potatoes under the same conditions froze spontaneously at -5°C or above. Whether varieties or species of wheat differ between themselves in this regard is not known, but the possibility presents an intriguing avenue for further research.

Frost Injury

Effects in the field.— Survey work on the effects of stem freezing by natural frosts in the field was continued for four crops, two of Festiguay and one each of Gamut and Timgalen. For those stems which did not bend over as a result of freezing, the only significant correlations between a measure of the stem damage (based on decreases in stem transverse areas) and nitrogen and phosphorus quantities in the grain produced, were for Festiguay. For this variety, at two locations, significant positive correlations were found between stem transverse areas and the total weights of nitrogen and of phosphorus in the grain, although the variations in these parameters accounted for by the measure of stem damage were only small, approximately 11 per cent and 18 per cent respectively. There were no correlations between the measure of stem damage and per cent nitrogen or per cent phosphorus in the grain. For Gamut and Timgalen, there were no significant correlations between the measure of stem freeze damage and quantities of nitrogen or phosphorus in the grain.

Glasshouse experiments.— An air cooled freezing clamp was used in the glasshouse to artificially freeze the growing internodes of Gamut wheat plants. For the frozen stems, this resulted in significant positive correlations between the measure of stem transverse areas and each of total stem heights, stem dry weights, glume dry weights, grain numbers, total grain dry weights and dry weight per grain. The variations in these parameters accounted for by the measure of stem transverse areas ranged from 37 per cent to 51 per cent. For the unfrozen stems of the control plants there were no such significant correlations. The dry weights of roots of the plants with the frozen stems were not decreased compared to those to the unfrozen controls. Nitrogen and phosphorus analyses of the various plant parts are in progress.

Leaching of ninhydrin positive substances.— Work was continued on the leaching into water of free amino acids and other ninhydrin positive substances from previously frozen plant material. The aim is to find out whether the leaching is quantitatively related to the known resistance to freezing of Australian wheat varieties and hybrids. This year, six varieties in groups of two differing in known freeze resistance were frozen and leached and four varieties from the field were treated similarly.

Nodes of the frost resistant selection 11F-4-5 leached out proportionately less ninhydrin positive substances, meaning that they sustained less cell freeze damage than Gamut. Similarly, nodes of selection 11F-4-9 leached out proportionately less ninhydrin positive substances than Gamut and nodes of selection 35D-1-5 leached out proportionately less ninhydrin positive substances than Falcon. These results for nodes parallel the known ear freeze resistance of these varieties. The situation with regard to internodes is less clear. On the basis of present results, therefore, nodes appear to be the most appropriate plant parts for this test.

PLANT PATHOLOGY

Verticillium Wilt of Cotton

Biology of V. dahliae.— The nature of *V. dahliae* on plant roots was studied in detail. Previous work has shown that the fungus can colonize the roots of a wide range of plants, including species that are immune to wilt. The study was undertaken to learn something of the nature of the fungus on plant roots and to observe if the colonization of wilt-immune plants was of any consequence in the long term survival of *V. dahliae*.

Contrary to published statements suggesting that *V. dahliae* will reproduce in the roots of wilt-immune species, work at Tamworth indicates that the fungus dies without reproducing the infective propagules. This work is continuing in an effort to understand the survival of *V. dahliae* under different crops. It is known, for example, that the fungus colonizes the roots of some plants more frequently than others and it is likely the longevity of the fungus is being influenced as well. One possibility is that germination in the presence of wilt-immune plants leads to a reduction in the life expectancy of the fungus in the soil. A different possibility is that the fungus may absorb nutrients exuding into the soil from the roots of wilt-immune plants leading to lengthening of the life expectancy of the organism. Information is now required as to whether survival is enhanced or reduced when the fungus germinates in the presence of wilt-immune species. Either way the short-term prospects of tailoring a rotation to reduce the level of *Verticillium* in soil appear good. This has been one of the aims of this programme for the past three years.

Chemical control of V. dahliae.— A programme was initiated in 1969/70 to screen fungicides for specific activity against *V. dahliae* in soil. It resulted in recognition of two complex dithiocarbamates as having good activity against *V. dahliae*. The better of the two compounds is a registered fungicide for the control of some foliage pathogens. Evaluation of these, and any other promising material will continued in glasshouse and field trials.

PLANT NUTRITION

Nutrition of Maize

The discovery that iron pyrites was highly effective as a sulphur fertilizer for maize growing in an alkaline sulphur deficient black earth from northern N.S.W. was reported previously. Chemical analyses have now been completed on plants harvested in this experiment.

Iron pyrites concentrates containing 47.1 per cent sulphur, and with 50 per cent by weight of particles less than 9 microns diameter, were applied at 340 lb per acre. They increase the total sulphur concentrations in the dried plant tops to the level obtained when sulphur was not limiting. The iron pyrites treatments increased the total absorption of sulphur into the plant tops by more than three times and increased the total sulphur concentrations in standard indicator leaves of the plants to the level indicating sulphur sufficiency.

*Nitrogen Nutrition of Wheat Following
Lucerne Leys*

Long-term experiments on the Research Station.— On the black earth site the cropping-out phase has commenced with the second crop being sown in 1971. During the lucerne phase, the older the lucerne stand, the lower the total dry matter yields in any one season, and the higher the total removal of nitrogen in the lucerne tops.

The high rainfall in late 1969 and January 1970 resulted in the fallow plots yielding highest and the lucerne plots lowest. Each plot was split for nitrogen fertilizer (urea), but responses occurred only on the continuous wheat and wheat-cowpeas rotations.

On the red brown earth site, lucerne yields were higher than in the previous season for the second consecutive year. In only two cases did the older lucerne stands yield less than the newer ones in contrast to the site on black earth. Generally, there has been no difference in the yield of wheat from the continuous wheat and wheat-cowpeas rotations. However the wheat-cowpeas rotation outyielded the continuous wheat in the years when cowpeas were not sown.

At each soil sampling so far the lucerne plots have much less moisture than the rest, even in the samples at 190–200 cm depth.

Short-term (district) experiments.— Of the five off-station sites, two have terminated, one after two crops and one after three crops. Of the remainder one is in its third year, one in its fourth and one in its fifth year after lucerne.

Out of a total of twelve harvests from first to third crops after lucerne, none have shown significant effects due to nitrogen fertilizer (urea) application in dry matter production at flowering, grain yield or total nitrogen removed in the grain. However there were significant increases in nitrogen harvested in the dry matter at flowering at four of the sites in second and third crops after lucerne. In each case, nitrogen rates above 40 lb per acre were not significantly different from each other and, in two cases, nitrogen rates above 20 lb per acre were not significantly different from each other.

Nutrition of White Clover

Phosphorus and sulphur on granite soils.— This series of experiments was continued into its fifth season at three sites. One site was sampled four times, one three times and one not at all during the season. The third site is being maintained only, as weed competition has limited the regeneration of the clover, making sampling meaningless.

The total yields were less than in the previous season, but yield responses to both current and residual applications of phosphorus were still marked. No obvious yield response to sulphur has been recorded.

Very good summer rains continue to contribute to the excellent growth of clover at the two sites. Chemical and statistical analysis of the accumulated data will continue.

SOIL FERTILITY

Omission type nutrient trials were carried out on four soils in the glasshouse to determine nutrients limiting plant growth. All soils, a solod from Narrabri, red brown earths from Baan Baa and Tamworth and a meadow podsolic from Barraba, showed deficiency in phosphorus. In addition the soils from Tamworth and Baan Baa were deficient in sulphur while the soil from Narrabri responded to lime. A field trial on the solod (Narrabri) has begun, the emphasis being placed on the lime and phosphorus requirements.

Glasshouse experiments examining the residual phosphate status of a red brown earth from the Research Station was begun in May, 1971, and will incorporate soil analyses for phosphorus with the aim of measuring the fixation and subsequent release of phosphorus applied as fertilizer.

Soil nitrogen studies are being carried out under a lucerne/wheat rotation to determine the build-up of nitrogen during the lucerne phase and the fate of the nitrogen in the wheat phase.

WHEAT GROWTH AND YIELD PHYSIOLOGY

Grain yield and crop growth data collected from variety x time of sowing experiments over the previous four seasons were combined for the first time, marking the completion of the first phase of the current research programme. A number of relationships relevant to the agronomy and physiology of the wheat crop in the Tamworth environment have emerged.

Results of the experiments demonstrated that the optimum time for sowing wheat in the area is in the period near the end of June and the beginning of July.

The superior yielding ability of the typical semi-dwarf variety, Mexico 120, was associated largely with its ability to produce more heads. A greater number of heads also appeared to be the major component underlying higher yields in crops sown at the optimum time. Time of sowing influenced grain yield in a more complex way; early sowing resulted in typical frost damage, while reduced grain set in later sowings became the important parameter associated with yield reduction.

Associations between grain yield and the duration of leaf area after flowering were poorer than expected from controlled environment studies and field studies in southern N.S.W. Coefficients of determination relevant to the yield/leaf area duration function were low. They varied between 68 per cent (Festiguay) and 76 per cent (Mexico 120) within varieties, and 68 per cent over all varieties. It seems likely that other factors with a significant influence on yield physiology were operative. Field experiments continuing this research programme have been started.

Equipment based on infra-red gas analysis is being assembled to study the photosynthetic performances of wheat varieties in relation to such factors as moisture stress and transient low temperature treatment. Detailed studies of variety responses to vernalization and photoperiod have been commenced.

PASTURE AND FORAGE CROPS

Research on pastures and forage crops at the Station includes a wide range of projects that also involve staff of the Divisions of Plant Industry and Animal Industry and the co-operation of officers of CSIRO. A large co-operative project, "Integration of pastures and forage crops on the north west slopes of N.S.W.", has been initiated with funds supplied by the Australian Wool Board.

A new building, to house the whole pasture section, with laboratories for chemical, microbiological and physical studies of soils, plant material and animals is due to be completed in August, 1971.

A survey ecologist has been appointed to survey the natural pasture of 7,500 square miles of the north west slopes. The survey will provide a strong base for pasture studies over the whole region.

A large grazing experiment to study the effects of phosphorus and sulphur fertilizers on sheep production will be commenced in spring, 1971, on natural pasture off the Research Station. This experiment is an integral part of the proposals to evaluate the pastures in use in the region. Previous grazing studies have been on the Station.

Previous evaluation studies, using grazing animals on lucerne and summer forage crops, have been terminated. A pilot study of grazed natural pasture is being continued on the Station.

Grazing studies on oats were started with breeding sheep and will be expanded with increased staff in the coming year. This work also is supported by the Australian Wool Board.

The fourth season of testing the response of sheep and lambs to grazing on summer forage crops was completed. Previous results, indicating that the crops are not suitable for lamb production, were confirmed. These studies are being prepared for publication. No further experiments are planned.

An experiment on grazing of lucerne finished in 1969. As a result of the finding that up to six dry sheep per acre can be supported in a rotation system, intensive studies on management practices have been expanded in combination with studies of root reserves of lucerne. Previous indications of growth responses to nitrogen application have been followed up with studies of the effects of nitrogen applied at six-weekly intervals throughout the year on stands aged one, two and four years.

A study of sod-seeding of winter cereals into established lucerne stands during 1970 also indicated that this practice may depend on nitrogen application for success. The latter studies will be combined with those on winter cereals to be conducted with stock.

Natural pastures, lucerne and winter forage crops provide the basic feed source for stock in this region. Studies have continued on annual *Medicago* and *Trifolium* species to determine the factors governing their regeneration. At the same time the naturalized population of root nodule bacteria is being investigated so that inoculation practices will be adequate for sowings of these species. It has been found that naturalized rhizobia are often ineffective on lucerne and there are indications that in some under-developed areas no suitable naturalized rhizobia which will infect annual legumes are present.

AGRICULTURAL RESEARCH DIRECTORATE, WOLLONGBAR STATION

Research workers at Wollongbar Agricultural Research Station are officers of the Division of Plant Industry, the Division of Animal Industry, the Division of Marketing and Economics, and of the Biological and Chemical Research Institute. Their work is summarised in the following notes and is reported more fully under the heading of the appropriate Division or Institute.

Plant Industry Research

Pasture species. — Pasture species research was expanded to include the nursery screening of new plant varieties, but the emphasis in this programme continued to be on the detailed evaluation of several of the more promising species available, mostly under grazing conditions. Further information was also obtained on the suitability of various species for different areas and soil types in the region.

Plant nutrition. — Plant nutrition research was concentrated on determining the maintenance fertilizer requirements of grazed grass pasture, and involved studies of soil, plant and animal responses under a range of fertilizer and stocking rate treatments. Special attention was also given to nitrogen fertilizer in view of its increasing importance in the region. Grass responses to nitrogen fertilizer were elucidated for different temperature, humidity and soil moisture conditions. Problems arising from the intensive use of nitrogen fertilizer on pasture were studied and corrective measures investigated.

Climatic factors. — Studies of the effect of climatic factors (particularly temperature and moisture) on the establishment and growth of tropical legumes and grasses were continued. Environmental conditions governing the establishment of tropical legumes were further defined, and the responses of grass to a range of soil moistures and evaporative demands were examined.

Forage crops. — Forage crop research was concerned with the evaluation of oat varieties and disease resistant vetches. Several relatively new varieties of oats continued to show superiority over most commercial varieties. Seed increase of a disease resistant vetch selection was commenced pending its release for commercial use.

Pasture management. — Pasture management and utilization investigations continued as co-operative projects between the Divisions of Plant Industry and Animal Industry. These studies provided information on the management techniques required for, and the animal production potential of, grass pastures fertilized with nitrogen, tropical legume-grass pastures, and native pastures with and without a legume component.

"Whole-farm feed-year" projects were continued to study the application of feed-year research results under commercial conditions. Increased animal production was obtained from the improved feed-year systems.

Weeds. — The crofton weed research project was successfully concluded and further recommendations made for the control of this weed. A study of the ecology of carpet grass areas was commenced with a view to developing techniques for the improvement of these areas.

Animal Industry Research

Pasture quality and animal production. — Studies of the properties of tropical pasture species which affect cattle production were continued, with emphasis given to examining pasture quality and its effect on animal response. Inherent factors contributing to plant feed quality were further defined, and techniques refined for the measurement of these factors. Differences in quality between a range of pasture species were measured and the effect of these differences on animal production determined.

Beef from dairy herds. — Research to develop systems for beef production from dairy herds was continued. Multiple suckling techniques for the early part of the lactation period were evaluated, the emphasis being on the number of calves suckled per cow, the length of the suckling period, and

the effect on post-weaning milk production. Comparisons were made with bucket-reared calves. An experiment to measure the growth of calves at different rates of multiple suckling and stocking over the entire lactation is being commenced.

Supplements. — Research into the use of energy and protein supplements for dairy cows was continued to investigate the response to supplements at different stages of lactation and levels of production, and to compare various types of energy supplements.

Pig nutrition. — Investigations into the protein nutrition of the growing pig were successfully completed. The programme designed to study the mineral and vitamin requirements of the growing pig was expanded to investigate the need for various mineral and vitamin additives with a range of commonly used base diets.

Economics Research

The development of a computer linear-programming model for use in selecting optimum feed-year programmes for dairy farms was continued.

Further economic evaluation of the "whole-farm feed-year" research projects was undertaken and provided additional information on the factors which contribute most of the economic success of dairy farm development programmes.

An investigation of the economics of intensive beef production on former dairying land and an economic evaluation of potential tree farming on the north coast were begun.

Biological and Chemical Research

Entomology investigations designed to improve control measures for the *Amnemos* weevil pest of legumes were continued, with emphasis at this stage of the programme being given to studying the ecology and behaviour of the insect.

Plant pathology research was continued, and covered both pasture and fruit diseases. Work on vetch diseases was concluded, and some recommendations made for control measures. "Kikuyu Yellows" disease investigations were taken to the stage where preliminary control procedures were outlined. Fruit disease research was concentrated on banana diseases.

Chemistry work involved the analysis of many and diverse samples from various research programmes. This often necessitated the refinement of specialised analytical techniques before satisfactory results were obtained. The study of the chemistry of soil and plant material following heavy applications of nitrogen and other fertilizers was continued. Special projects were commenced to examine pesticide residues in grazing animals, and to develop a chemical method for determining maturity of avocados.

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

GENERAL

Retirement of Director

Mr H. K. C. Mair retired from the position of Director and Chief Botanist on June 30, 1970, completing 24 years service, the final six years as Director. Mr L. A. S. Johnson, Deputy Chief Botanist, acted as Director until October 6 when the new Director, Dr J. S. Beard, took up his position. Dr Beard had been Director, King's Park and Botanic Garden, Perth, Western Australia, for the previous nine years.

Herbarium Accommodation

The problem of accommodation of the National Herbarium collections becomes more acute every year as the number of specimens mounts and the staff increases. The building erected in 1899 to house one botanist and a few thousand specimens, today houses over a dozen botanists and nearly a million specimens. Severe overcrowding results in loss of working time by the staff and the fire hazard is extreme. The professional staff of this herbarium is the largest of any in Australia. It is also the most highly qualified, including four with doctorates, and the most active in fundamental aspects of research. However they work in the only major herbarium building in Australia which has not been rebuilt to modern standards.

National Projects

The Director and Deputy Chief Botanist participated in discussions with other Australian taxonomic botanists and Fellows of the Australian Academy of Sciences, held in Melbourne, Canberra and Brisbane, on proposals for a new Flora of Australia.

The Director has been similarly involved in proposals for a vegetation map of Australia at the scale of 1:1,000,000 and is a member of an informal inter-state committee.

The Director and the Deputy Chief Botanist participated in a meeting in Canberra to consider unification of data-recording and possible use of computer storage and processing for information retrieval of herbarium records throughout Australia. The possible application of automatic data processing to recording of the living collections in the Botanic Gardens is also being considered.

Condition of the Gardens, Domains, Parks and Grounds

The Royal Botanic Gardens, Outer and Inner Domains, Government House Grounds, Admiralty House Grounds as well as Centennial and Queens Parks were all satisfactorily maintained and a number of improvements achieved. Special funds were again made available for development in Centennial Park. Preliminary work at the Mount Tomah Annexe in the Blue Mountains, started in the previous year, lapsed owing to staff difficulties but was recommenced in April following the appointment of a Supervisor.

Staff Notes

Mr L. A. S. Johnson, Deputy Chief Botanist, was awarded the degree of Doctor of Science by the University of Sydney.

Dr W. L. Chew, Botanist, was invited to participate in the Royal Society of London Expedition to the New Herbrides in 1971.

Miss Neridah Ford, Botanist, resigned in May, 1971 after 24 years' service.

Messrs. N. Lander and S. Jacobs joined the staff during the year as supernumerary botanists.

Mr Warwick Watson, Superintendent, Royal Botanic Gardens, was awarded a Public Service Board Fellowship for an overseas study tour of botanical and allied institutions in Europe and North America.

Mr B. Dangerfield, formerly Supervisor, Parks and Gardens, Albury, N.S.W., commenced duty as Assistant Superintendent, Royal Botanic Gardens, on July 6, 1970, filling a vacancy of some two years' standing.

Mr R. Grewcoe was appointed Supervisor, Mount Tomah, in April, 1971. This was the first staff appointment to the Annexe.

NATIONAL HERBARIUM

Publications

Contributions from the New South Wales National Herbarium. — Volume 4, Number 3, and Volume 4, Number 4, were both published in December, 1970.

The "Flora of New South Wales". — No. 58, Lorantheae, and No. 58A, Viscaceae, by Dr B. A. Barlow, Flinders University, S.A., are with the Government Printer.

Other publications. — The book "A Classification of the Eucalypts", by Dr L. A. S. Johnson and Professor L. D. Pryor of the Australian National University and launched at the A.N.Z.A.A.S. Congress. The authors had been working together on the book for over ten years.

Publications by members of the staff are listed in Appendix II of this Report.

Projects Completed or Proceeding

Work began on a census of New South Wales plants from the records in the Herbarium and in publications and notes.

Studies were initiated for a revision of the family Urticaceae in Australia and on the general *Pilea* (Urticaceae) and *Piper* (Piperaceae) for the Malesian region.

The Herbarium collection of *Wahlenbergia* (Campanulaceae) was reclassified and rearranged on the basis of work by Professor R. C. Carolin.

A chemotaxonomic study of certain species of *Eucalyptus* in the "Ash" group was initiated in collaboration with the Museum of Applied Arts and Sciences.

Chemotaxonomic studies in the genus *Acacia* in collaboration with Professor D. G. Roux of South Africa were actively pursued.

Studies continued on Tremandraceae, Gramineae (*Stipa*, *Sporobolus*, *Triodia*), Juncaceae, Casuarinaceae, Restionaceae (towards a comprehensive systematic and evolutionary review of the family), Proteaceae (especially towards a revision of *Grevillea*), Liliaceae, Scrophulariaceae (*Veronica* and allied genera), Orchidaceae, Caesalpiniaceae, Papilionaceae, Myrtaceae (*Eucalyptus*), and various pteridophyte groups.

Field Investigations

Areas of the State visited on collecting and study trips by staff botanists included the western and far-western plains, the Illawarra and Jervis Bay districts, Mount Coricudgy District, the Pigeon House Range, the Brewarrina district, Lake George, Araluen-Sassafras areas, Twofold Bay, Kosciusko National Park, Blue Mountains.

The Pigeon House Range was reconnoitred from the air prior to field work in order to locate stands of an undescribed species of *Eucalyptus* found there. The species were subsequently investigated on the ground.

Dr Johnson and Mr Blaxell accompanied Professor Pryor and Dr Paton of the Australian National University on a field trip to North Queensland to investigate *Eucalyptus* species of particular taxonomic interest.

The Algologist, Mrs Jones, several times visited the Braidwood district to pursue her work on toxic algae in farm dams and ponds.

The ecologist made special studies in the Mt Coricudgy district, Pigeon House Range, and in mallee at West Wyalong.

At the request of the Lord Howe Island Board, staff participated with members of the Australian Museum, National Parks and Wildlife Service, and CSIRO Division of Wildlife research, in a biological survey of the island. Three visits to the island resulted in an inventory of plant species and plant communities. A vegetation map on scale of 1:15,840 was prepared.

Interstate Visits

The Director and three senior botanists attended the 43rd A.N.Z.A.A.S. Congress in Brisbane where they presented papers and/or participated in symposia or committee meetings.

Dr Johnson and Dr Briggs visited various parts of southern and central Queensland, making field observations and critical collections of *Eucalyptus* and other genera.

While on leave, Dr Briggs visited the herbaria at Alice Springs and Darwin, and made some collections in Central Australia. She also attended the 42nd A.N.Z.A.A.S. Congress in Port Moresby, visited the Lae Herbarium and took part in extensive field trips in various parts of New Guinea.

Dr Johnson and Mrs de Nardi worked for short periods at the National Herbarium, Melbourne, in connection with research projects.

Dr Tindale examined collections of *Acacia* at the South Australian and Queensland Herbaria and undertook work in the field in both states.

Dr Chew worked at the CSIRO Herbarium, Canberra; Mr McGillivray at the Queensland Herbarium.

PLANTS NEWLY RECORDED FOR NEW SOUTH WALES

Two new species of *Juncus* were recognized and will in due course receive published names.

Eucalyptus exserta, a Queensland species, was collected near Inverell.

Asperula euryphylla above Geehi Reservoir, Snowy Mountains — the first record outside Victoria.

Eutaxia microphylla var. *diffusa* between Temora and West Wyalong — first record outside Victoria.

During a biological survey 28 species new to the recorded flora of Lord Howe Island were found. 22 are believed to be naturalized exotics.

Orobanche australiana, a parasitic herb, from Tibooburra — previously known from South and Western Australia.

Dodonaea bursariifolia, near Balranald — known from Victoria, South and Western Australia.

Fimbristylis brownii and *Cyperus bowmanii*, Brunswick Heads — known from Queensland.

Cyperus stradbokensis from Woodburn — known from southern Queensland.

Zannichellia palustris from Ash Island near Newcastle — known from South Australia.

Two new species of *Eucalyptus* from the ranges between the South Coast and Southern Tablelands. They are being described and names will be published for them.

RARE SPECIES AND EXTENSIONS OF RANGE

Dodonaea triquetra was found at Pindari Dam on the north west slopes. It formerly was known from the north coast and central tablelands.

Velleia perfoliata was found near Wollombi. This was a northern extension of range from the Colo area and third collection of the species in the National Herbarium.

Persoonia marginata was collected near Dark Comer in the Bathurst district, for the first time since 1915.

A collection of *Gypsophila australis* from Menangle Park near Camden, made by an officer of the Glenfield Veterinary Research Station, was the first record for the central coast district for over 100 years.

Atriples quinii was collected at Nuntherungie near White Cliffs. This was the first collection of this saltbush in N.S.W. for 60 years.

Poranthera triandra was found near Balranald — the second collection from this state.

Keraudrenia corollata var. *denticulata* was collected near Grafton — the fourth collection from N.S.W.

Toechima tenax was collected on Stott's Island — the second collection in N.S.W.

Styphelia laeta var. *latifolia* was found near Kanangra Walls. It was previously known from the western slopes and the north coast.

Cyperus iria collected near Richmond, had previously been recorded only in the western plains. It is a widespread tropical species.

Baeckea divaricata was collected near Wadbilliga — the third collection in N.S.W.

Atriplex morrisii was collected from a station near Broken Hill. It had not been collected since 1924. It was formerly said to be common in the locality.

SIGNIFICANT COLLECTIONS FROM OTHER STATES

Fruiting specimens of *Nuytsia floribunda*, the Western Australian Christmas Tree, and material of *Acacia porphyrochila*, *A. loxophylla* var. *nervosa*, *A. dielsii* and an undescribed *Acacia* were added to the National Herbarium collections as a result of Dr Tindale's fieldwork in Western Australia the previous year.

A number of interesting algal collections from the Gove Peninsula, Northern Territory, were added to the Herbarium.

The incoming Director brought with him a recent collection of some 400 specimens from Western Australia which included many species not previously represented in the National Herbarium and material of several taxa of *Eucalyptus* which are probably distinct from any known species.

BOTANICAL EXCHANGES

Botanical specimens. — The 6,075 duplicate botanical specimens distributed to other herbaria represented a considerable increase over the previous year and resulted in substantial reduction, and in some cases elimination, of exchange debits with these institutions.

Special collections. — A further large number of wood samples of *Acacia* was specially collected and sent to Professor D. G. Roux, University of the Orange Free State, South Africa, to further the collaborative studies on *Acacia* chemosystematics.

Fresh, dried, or fixed material of species of various families was specially collected for botanists, chemists, horticulturists and pharmacologists in Australia and overseas.

Seed collection and exchange. — A considerable increase in number of field collections of native plant seed was achieved over that of the previous year. New arrangements were instituted to cope with handling and storage of this seed. A seed cleaning machine was installed and is greatly increasing efficiency in processing. Storage methods were completely reorganized.

In the seed exchange programme, 1,689 packets of seed from collections listed in the 1969–70 *Index Seminum* were distributed to 111 Australian and overseas institutions. The 1970–71 *Index Seminum*, for distribution to all institutions with which exchange relations are maintained, is being prepared.

Botanical Collector. — The Botanical Collector spent considerable time in the field collecting seed and herbarium specimens for record and exchange, other plant material specifically required for research in the National Herbarium and material to meet other institutions' requests.

MISCELLANEOUS AND SPECIAL SERVICES

Special services by staff members. — Dr Beard is a member of the Australian National Committee of the International Council of Museums (ICOM) and a member of Council of the Ecological Society of Australia.

Dr Johnson continued to serve on the Council of the Linnean Society of New South Wales and was elected President for 1971. He continued as a member also of the Parks and Reserves Scientific Committee advising the Minister for Lands and a committee convened by the State Planning Authority to consider environmental questions.

Dr Tindale continued as Secretary of the Systematic Botany Committee of Section M. of A.N.Z.A.A.S., and as a member of the Special Committee for Pteridophyta of the International Association of Plant Taxonomists.

Dr Briggs served on a committee set up by CSIRO to discuss possibilities of A.D.P. methods in herbaria.

Mr Blaxell was guest lecturer at the University of New England 1970 Spring School at Lismore.

The Ecologist, Mr Pickard, assisted National Parks and Wildlife staff in setting up a vegetation survey of the Nadgee Nature Reserve. He and the Senior Landscape Designer, Mr M. Watson visited the Liddell Power Station in the Hunter Valley to examine open-cast coal mines and to advise on suitable measures for revegetating the spoil heaps.

Police, customs and excise activities. — Information and identifications were furnished to the Police Department and to the Commonwealth Department of Customs and Excise on matters concerning drug plants, prohibited imports, and plant material providing evidence in criminal cases. Court appearances, which often had to be made at country centres, involved botanists for some 18 days in all. The definition of "Opium Poppy" in its botanical and legal aspects were discussed with officers of the Division of Plant Industry, the Department of Local Government and Public Health and the Commonwealth Department of Customs and Excise.

Lectures and Seminars. — A joint monthly taxonomy seminar was held at the Herbarium with staff of the University of Sydney Botany Department. Various members of the staff lectured on topics related to their work to interested clubs, groups and societies.

HERBARIUM LIBRARY

New material totalled 1,371 items (109 books, 1,023 issues of periodicals, 239 pamphlets and sundry maps, trade publications and reprints); 362 items were catalogued. Periodical issues indexed totalled 699. Donations to the library were 18 books. Loans to members of staff totalled 992 and to other libraries 247.

PROFESSIONAL VISITORS

Study Facilities. — Many notable visitors from overseas and from Australian scientific institutions to the Botanic Gardens and Herbarium were given facilities to study and/or consulted with the staff. Botanists or the Botanical Collector accompanied some of the visitors in the field.

Overseas visitors included: Dr W. T. Stearn (British Museum of Natural History); Dr Robert E. Ornduff (University of California, Berkeley); Professor M. I. Birdsey (Miami); Mr B. Severne (Massey University, New Zealand); Mr and Mrs W. Gregong Rocksodichardjo and Dr Mien Rifai (National Biology Institute, Bogor, Indonesia); Dr K. Nakajima, a noted Japanese landscape architect; Dr A. Wills (University of Florida, U.S.A.); Mrs Frances Perry (Royal Horticultural Society, Great Britain); Dr D. S. Correll (Texas, U.S.A.); Mr K. L. Morgan (Secretary, International Federation of Park Administration); Mr J. R. B. Evison (Brighton, England); Mr A. Raad (Rotterdam, Netherlands); Mr P. Jew (Auckland, New Zealand); Mr L. Dennis (Hamilton, Canada); Messrs. J. E. Shaw and T. Linley (South Africa); Messrs. I. Mahmoud and S. P. Lamb (Kuala Lumpur, Malaysia); Mr H. G. Gilpin (Christchurch, New Zealand); Mr G. H. Spalding (Los Angeles State and County Aboretum); Miss E. Scholtz (Brooklyn Botanic Gardens); Messrs. I. Chowdhry, S. Ahmed and M. S. Korejo, and Brigadier Riaz-ul-Haq, (Pakistan); Prof. R. O. Belcher (E. Michigan University, U.S.A.); Mr J. Braggins (University of Auckland, New Zealand); Dr M. M. Zenk (Ruhr-Universitat, W. Germany); a group of four scientists from the Geological Institute and Institute of Oceanology of the Academy of Science of the U.S.S.R.; Dr H. de Mink (Leiden, Holland); Dr and Mrs T. Harder (Santa Barbara, California); Mr R. E. Nasution (Botanic Gardens, Bogor, Indonesia); Mr C. Stanford (University of Calgary, Canada); Mr C. E. English (Seattle, U.S.A.); Mr and Mrs A. C. Bivins (Miami, Florida); and Mr and Mrs M. Parsons (Christchurch, New Zealand).

Visitors from Australia and New Guinea included. — Sir Thomas Meagher, President of the King's Park Board, Perth; Messrs. G. Chippendale, N. Hall and M. I. H. Brooker (Forest Research Institute, Canberra); Dr M. E. Phillips and Mr D. Vernon (Canberra Botanic Gardens); Mr J. S. Womersley and Mrs A. Miller (Division of Botany, Lae, New Guinea); Mr H. A. Fraser (Wagga Agricultural College); Mr J. D. Firth, Executive Secretary, Australian Institute of Parks and Recreation; Dr P. H. T. Uhlherr (Monash University); Dr Ilma Stone and Mr J. F. C. Osborne (University of Melbourne); Professor N. C. W. Beadle and Mr B. E. Norton (University of New England); Dr J. R. Cannon (University of Western Australia); Mr Leo Butler and Mr W. Gable (Rutile and Zircon Development Association); Mr N. Byrnes (Northern Territory Administration, Darwin); Mr R. H. Kuchel (Superintendent, Botanic Gardens, Adelaide); Mr Bruce Maslin (Western Australian Herbarium); Professor L. D. Pryor (Australian National University); Dr P. S. Lavarack (University of Queensland); Dr S. Twentyman (Keith Turnbull Research Station, Victoria); Dr I. R. Price (James Cook University, Townsville); Dr I. A. Staff and Miss D. Simmons (La Trobe University, Victoria); Mr L. Pedley (Queensland Herbarium); Dr R. K. Crowden and Miss J. Jarman (University of Tasmania); Messrs. J. P. Farrell and G. A. Farr-Smith (University of Melbourne); Mr P. C. Wilson (Western Australia Herbarium); Dr L. J. Webb (CSIRO, Brisbane); Dr D. Ashton (University of Melbourne); Dr N. T. Burbidge, (CSIRO, Canberra); Mr R. F. Swinburne (Botanic Gardens, Adelaide); and Mr S. Kochman (University of New England).

Botanists and other scientific workers stationed in Sydney also visited the Herbarium for study or discussion.

ROYAL BOTANIC GARDENS

The Gardens were maintained in good condition and a number of improvements were effected. The advancing age of many of the plantings poses a growing problem and a general overhaul of the collections and new landscaping treatments are becoming due.

The hour at which the Gardens are opened daily to the public was amended from 7.30 a.m. to 8 a.m. to save overtime costs for staff.

Nursery

The main activity continues to be concentrated in the central nursery at the Botanic Gardens. Here new introductions made as seed from overseas are propagated. There is also a programme of propagating from old and declining specimens in the Gardens to prepare for their replacement and to build up stocks for renewal of shrubberies. A small shade house was erected for propagation by seed and work started on the installation of a new oil-fired boiler for the small propagating glasshouse.

Glasshouses and Buildings

It proved impossible to erect the new major display glasshouse scheduled for 1970–71 owing to difficulties over tenders. Erection is expected in 1971–72. Work began on the installation of new oil-fired boilers to provide heating for all existing glasshouses in the nursery as well as the projected new display house. There should be a substantial reduction in smoke nuisance from the boiler house.

Pending provision of the new display house, it was decided to open the best of the old houses to the public from 1 to 3 p.m. daily and a display exhibit was arranged. Glasshouse collections continue to be build up and space is beginning to be a problem. Redevelopment of the old shade house for a collection of native orchids and ferns was begun. Some buildings were renovated and painted and minor new buildings were erected.

Educational and Extension Activities

Exhibitions. — An educational exhibit was staged again in Hyde Park for the Waratah Festival. This year it depicted environmental changes between 1770 and 1970, stressing the current problems of pollution and conservation.

At the request of the Royal Agricultural Society a large central exhibit was staged in the Horticultural Pavilion at the Royal Easter Show. It comprised a display of cacti and succulents showing the range of their distribution throughout the world, and featured a large plant of prickly pear with posters showing its economic importance as a noxious weed.

Lectures. — In co-operation with the Japan Information Service, two public lectures in the State Office Block Theatre were arranged for Dr K. Nakajima, a visiting Japanese landscape architect. A lecture was arranged in co-operation with the Australian Institute of Parks and Recreation at the University of New South Wales on "Parks and Gardens of England and The Netherlands" by Messrs. Evison, Morgan and Raad who were on their way to the International Congress of Park Administration in Canberra.

The Director lectured on "The Role of the Botanic Garden" to the Garden Club of Australia Summer School at the University of Sydney and gave numerous similar talks to horticultural groups. The Senior Landscape Designer continued his series of lectures to postgraduate students in Towns and Country Planning at the University of Sydney.

Professional Institute. — The Director and Superintendent attended the Sixth International Congress of Park Administration held in Canberra concurrently with the Congress of the Australian Institute of Parks and Recreation. Mr W. Watson was elected a council member of the latter body. Later, a New South Wales Division of the Institute, which had been in abeyance for three years, was reformed; Dr Beard was elected President.

Landscape Designing and Associated Services

Internal. — Improvements were: realignment of the fences for the Outer Domain Depot and Domain Cottage and the demolition and reconstruction of the associated stone walling; construction under contract of new walling associated with landscaping of the Macquarie Street frontage of the Public Library; re-design of the pathway from Government House to the Botanic Gardens; re-design of the Loch Avenue entrance at Centennial Park to ease traffic congestion; preparation of preliminary plans for a new succulent garden and a preliminary survey of existing features in the central area at Mount Tomah Annex; establishment of a massed planting of Azaleas and Rhododendrons in the area adjacent to the Kendall Memorial, and a variety of material to complete the landscaping of the newly paved area adjacent to the main ornamental pond in the Lower Gardens.

External services. — A landscaping plan and report, followed by supervision of contract, was undertaken for an area at Prince Henry Hospital.

Landscaping plans and/or reports were prepared for: Municipal Council, Singleton (Burdekin Park); Wagga Agricultural College; Commonwealth Plant Quarantine Station, Rydalmere; Glenfield Veterinary Research Station; Goulburn City Council (Victoria Park); Wollongbar and Condobolin Research Stations; Museum of Applied Arts and Sciences; Parramatta Girls' Training Centre; Dural Primary School.

Advisory visits included Camden Aerodrome for Department of Civil Aviation, Mosman Municipal Council, cemetery extensions for Port Macquarie Municipal Council, Sydney Airport for Qantas, Vales Point Dam for the Electricity Commission. A general landscape report on surrounds for a new type of post office was prepared for the Commonwealth Department of Works.

Seed and plant introduction. — A total of 989 entries were made in the register of accessions of plant material. Most accessions resulted from our exchange programme with other botanical gardens around the world. Of the accessions, 647 were of seeds or spores, of which 493 were from overseas institutions or individuals. Most exotic seed obtained was of temperate species suitable for stocking the Mt Tomah Annexe. There were 154 seed lots from within Australia. The remainder of the accessions comprised plants, cuttings and bulbs, mainly from Australian sources. The most noteworthy item among these was a batch of 794 plants donated by Adelaide Botanic Garden. Nearly all were temperate species from Mt Tomah.

Other interesting accessions of exotic plants included: *Erythrina*, 13 tropical American species; *Macadamia neurophylla* and *M. leptophylla*, from New Caledonia; *Rhaphidophyllum hystrix*, a rare palm from Florida; and *Proten roupelliae*, a tropical African species.

Native plants. — Approximately 60 accessions of Australian plants from known wild sources have been successfully established in the nursery. This represents a step toward documenting living collections as much as possible, a policy actively encouraged by international scientific bodies. An attempt is being made to build up documented stocks, particularly of local natives from the New South Wales coastal region many of which have been unjustly neglected for ornamental purposes.

The native plants and seeds received also included a good number of palms and cycads with which it is hoped to enrich our specialist collections of these groups.

Donations of Plant Material

Donations of plant material included: selection of rockery plants, from Reid Bros. Nursery, Pennant Hills; collection of native orchids of the New Hebrides, from Mrs P. Wells; large collection of orchid species and cultivars, from Mrs R. C. Jenkins, Mosman; orchids, from Mr E. Gordon and Dr K. Kirkland; *Asplenium nidus*, from Miss Judith Cassell; large collection of plants, from the Adelaide Botanic Garden; and assorted shrubs, from Catts Nursery, Swanes Nursery and Reid Bros. Nursery.

Royal Agricultural Society Awards

The Royal Botanic Gardens exhibited horticultural material in open competition at the Royal Agricultural Society's Easter Show for the fourth successive year with notable success — 24 championship ribbons and 48 first prizes and 52 second prizes were awarded. The Gardens also received the Banksian Medal of the Royal Horticultural Society of England for the highest total of prize money in all classes of the Horticulture Section of the Show.

Training and Development of Staff

The Superintendent, Royal Botanic Gardens, continued to serve as a member of the Horticultural Advisory Committee of the Ryde School of Horticulture.

Courses. — There were 12 officers in various stages of the three-year Horticulture Certificate course at Ryde; one graduated. Two other officers completed courses in management and two in landscaping. Two apprentice plumbers and one apprentice painter are employed. In-service training was provided for juniors taking the Certificate course in Horticulture to supplement the instruction given at Ryde. Monthly training meetings were held for Foreman and a monthly seminar for qualified horticultural staff was instituted.

Fellowship award. — Mr W. Watson, Superintendent of the Royal Botanic Gardens, was awarded a Public Service Board Fellowship and left in March 1971 for a 4 month study tour of botanic gardens and similar institutions in Europe and North America.

Overseas trainees. — One of the two Chinese officers of the Urban Services Department, Hong Kong, successfully completed his horticultural training in December and returned home. The other still has a further year to complete.

Assistance to the Division of Horticulture. — An officer of the Division of Horticulture underwent a short period of concentrated practical training in plant propagation and glasshouse management before taking up duty at the Department's Quarantine Station at Rydalmere.

Vandalism

No major damage occurred during the year. Minor damage continued, mainly to rubbish bins and seats. In the Domain young trees were interfered with in some cases, lawns were damaged by cars parked illegally at weekend and litter was an increasing problem.

THE DOMAINS

It is the policy of the Trustees to preserve the Inner and Outer Domain as open space for recreation. During the year the Trustees had to consider demands for land in connection with the Eastern Suburbs Railway and the Opera House. Demands for the use of grassed areas for parking cars during transport strikes and during the Christmas shopping period had to be met on several occasions in spite of damage done to the lawns. The Domain continued to be popular for Sunday public oratory and was used for the formation and disbandment of processions and rallies of civic or national significance.

The limited playing area available for bowls, football and hockey received regular use, particularly for lunch-hour football. Basketball courts were in regular use on the area above the Domain Parking Station.

Very heavy rain during summer caused exceptionally strong growth of grass and there was difficulty in keeping lawns mown. The layout of lawns, beds and shrubberies in the area of the Robert Burns statue was improved and some redundant fences were removed.

GOVERNMENT HOUSE

The gardens of Government House were discussed by the Director with His Excellency the Governor. A landscaping plan was promised. Botanic Gardens staff continued to maintain the gardens and provide interior floral services for Government House.

ADMIRALTY HOUSE

Maintenance and development of the grounds of Admiralty House were discussed with the Controller and a recommendation made for improvements when funds are available.

CENTENNIAL PARK

Restoration and improvement of Centennial Park continued. Dredging of ponds is still not completed. The lakes and ponds are now being used to provide water for irrigation of playing fields and cultivated areas during dry weather. Reticulation was again extended during the year and two electric pumps of large capacity were installed to feed the whole system.

Improvement of roads and pathways and renovation of the external park railings also continued. Drainage works were carried out at the Randwick Racecourse entrance to the Park. Further trees were planted and facilities for equestrians extended and improved.

MOUNT TOMAH ANNEXE

A contour plan was obtained from the Department of Lands, and a ground survey of the cultivated area was prepared as a basis for planning. At least two-thirds of the property is covered with natural forest, both rain forest and eucalypt, which will be preserved. The former cultivated area of the flower farm occupies a moderate to steep slope with a north-east aspect on a basaltic soil, and is planted with a network of high and overgrown laurel hedges. The appointment of a supervisor for maintenance and development of the area in April 1971 enabled site clearing and preparation to be continued.

A very valuable gift of 794 plants representing 291 species and cultivars suitable for planting at Mount Tomah was received from the Adelaide Botanic Garden.

DIVISION OF MARKETING AND ECONOMICS

CHANGE IN DESIGNATION

During the year the title of the Division was changed from the Division of Marketing and Agricultural Economics to the Division of Marketing and Economics, and approval was granted for the re-designation of Economics Research Officers and Senior Economics Research Officers as Economists and Senior Economists respectively.

STAFF

Increased Professional Establishment

The Division's professional staff increased by one. Six new appointments were made including one officer on secondment from the Treasury A.D.P. Bureau; but one officer who was employed on a supernumerary basis last year was transferred to a lecturing position at Hawkesbury Agricultural College, and four officers resigned during the year.

The number of establishment positions increased by six during the year. The three officers supernumerary in July 1970 were absorbed but there was another officer supernumerary in June 1971 awaiting appointment to the most recently created position. There are three other vacancies at present. These are being held because of the large number of trainees graduating at the end of 1971.

One major addition to the establishment was the creation of a position of Special Economist (Surveys). This position was filled in November 1970. The appointee is responsible for planning and supervising cost/income surveys of the dairy industry and investigations into the cost of processing milk and the production and manufacture of other dairy products. This new Divisional activity is a result of the Dairy Industry Authority Act, 1970, which became operative from July 1970.

Professional Changes

The Chief of the Division Mr C. J. King, who had been absent on sick and recreation leave for some time, retired on September 1, 1970. Mr P. C. Druce, who had been Acting Chief of the Division was appointed as Chief.

Other staff changes included the appointment of Dr D. E. Maccallum as Deputy Chief and Mr J. W. Elston as Principal Extension Economist. Both of these officers had been acting in these positions during Mr King's absence. Mr F. H. Drane, Economist, was appointed to the newly created position of Special Economist (Surveys). The position of Principal Research Economist continued to be occupied on an acting basis, pending the return of three officers from study leave or secondment.

Secondments and Study Leave

At the end of June, 1971, the Division had one economist on secondment to the Australian National University, Canberra while two officers continued on study leave in the United States. All three officers are due to return to the Department late in 1971 or early 1972.

Two other economists entered on 12 months study leave in February 1971 to undertake post graduate Diploma courses at the University of New England, Armidale. In addition three officers attended the Universities of New South Wales and Sydney part-time.

At the end of June, 13 officers were candidates for Masters Degrees, three for the Degree of Doctor of Philosophy, one for the Diploma in Rural Accounting, and one for the Diploma in Agricultural Economics.

The Recruiting Programme

The Division's recruiting programme continues to be based mainly on the university trainee system. At June 30, 1971, there were 23 such trainees in Agricultural Economics nine of whom are to graduate at the end of 1971. Of the 23 trainees, 4 are to be attached to agricultural colleges 2 of those in final year, and 2 others.

REPRESENTATION ON COMMITTEES

The Chief of the Division continued as N.S.W. Government representative on the Australian Tobacco Board. Following the appointment of the Acting Chief as Chief of the Division, the Special Economist (Commodities) was appointed the alternate member. The Chief has also acted as State Agent on the Tobacco Industry Leaf Finance Agency.

The Chief continued as a member of the Dairy Industry Prices Tribunal and as a Departmental representative on the State Development Co-ordinating Committee and the Markets Joint Sub-Committee of the Illawarra Regional Development Committee. He also continued as Chairman of the Inter-Departmental Committee to enquire into the canned deciduous fruits industry. This Committee, of which a Divisional economist was executive officer, completed its investigations and made its final report to the Minister for Agriculture for transmission to the Premier.

The Chief also continued as Chairman of the Advisory Committee for the Diploma in Agricultural Courses — Business and Social Studies and as a member of the Board of Studies. He and a Divisional economist acted as members of the New South Wales Poultry Advisory Board Sub-Committee on Egg Production.

The Deputy Chief, was appointed as a representative of the Standing Committee on Agriculture to the ACCRA Committee (Australian Committee for Coding Rural Accounts), he was also appointed by the Standing Committee on Agriculture as Convener of an Inter-State Committee to investigate farm management services provided by the Australian states.

The Principal Extension Economist is on the organizing committee for the 1971 Commonwealth Sheep and Wool Refresher Course, and is also a member of the organizing committee for the 1972 Commonwealth Refresher Course in Dairy Farm Management.

The Special Economist (Crop Forecasting) is a member of the Inter-Departmental Committee on Coarse Grains and Chairman of the N.S.W. Wheat Forecasting Committee.

The Special Economist (Commodities), in addition to being alternate member on the Australian Tobacco Board, is a Ministerial nominee on the recently formed Grain Sorghum Marketing Board for the State of N.S.W. He also acts as a permanent observer on the Committee of the Commonwealth/Industry Conference on Vegetable Oilseeds, Oils and Meals.

One of the economists at Leeton is a member of the Inter-Departmental Committee to investigate the size of large area Coleambally farms and the Inter-Departmental Committee to investigate Coleambally horticulture farms, both set up by the Minister for Conservation. Other Economists acted on various Intra-Departmental and Intra-Divisional Committees.

RESEARCH

In the Division's research programme, 6 projects were completed, work continued on 13 projects and 6 new projects were commenced. Major projects are described briefly below and publications are listed in Appendix II of this report.

ECONOMICS OF PRODUCTION

General

Survey of pasture problems on north west slopes. — Progress on this project was delayed by new duties for the officer responsible and also by computing difficulties. A report is expected before the end of 1971.

Enterprise gross margins for northwestern N.S.W. — Owing to changed duties of the officer responsible, the project has been discontinued. Preparation of the bulletin incorporating the results, mentioned in last year's report, will not now be completed. Information from the project has been published in State and regional publications for farmers. The results have been a considerable value in the region.

Farm management accounting in practice. — This project was expanded to include a new set of financial records as well as production records, and so enable analysis both by computer and manually. The recording system was prepared. It is now being tested on the Bega Dairy Demonstration Farm for the 1970/71 financial year.

The costs of galvanised burr. — Work on this project, initiated last year, was delayed by a temporary shift in emphasis of the officer's programme because it was found that, with present wool prices, any form of control would be economically unfeasible. The study is being modified to look more at the general financial situation of landholders affected by galvanised burr. An attempt to measure the effects of the weed on farmer's incomes was abandoned because it was impossible to separate out the effects of drought and falling wool prices.

Structure of farms in Lower Hunter. — This study, designed to investigate the socio-economic structure of Lower Hunter farm businesses, and the effect of this structure on farm adjustment, continued. Data collected from the survey is being analysed.

Mobility of farmers in the Northern Region. — This project, which commenced last year, was undertaken to evaluate the factors affecting farmer adjustment and to ascertain the characteristics and future plans of those whose properties are for sale. Considerable progress has already been made. The survey has been completed and a preliminary analysis of the data has begun.

North coast land use adjustment survey. — The economics of alternative enterprises on dairy farms on the far north coast are being studied. Initially intensive beef production and private forestry are being considered.

In the beef study, the factors affecting financial success will first be examined using regression analysis and comparative analysis. Then a linear programming model of a farm in beef production will be constructed to evaluate various management, feeding and cropping practices as well as different forms of production. In the forestry study the profitability of various species will be examined and the capital requirements and gestation period of the investment determined.

Dairy Farming

Whole farm studies: far north coast. — Data collection and analysis on the remaining case study farms continued during the year. Farm profitability, cash flows and internal rates of return have been calculated for 1969/70. Results for 1970/71 are being collated.

Optimum feed year programmes — north coast dairy farms. — A satisfactory model to determine optimum feed year plans under a range of resource situations and cost/price conditions was developed. It has been found that plans are quite sensitive to assumptions as to feed/output coefficients and that labour appears to be an important limiting resource. Progress on the study has been impeded by transfer of the officer concerned.

Farm development plans: north coast dairy farms. — This project was planned as an extension of the study of feed year programmes. It was terminated when the officer responsible was transferred.

Factors impeding adjustment on far north coast low income farms. This major study, mentioned in previous reports, is now completed. It was found that previous studies of the low income problem on the far north coast had not satisfactorily defined "inefficient use of existing resources" or "inferior welfare status" of existing farmers. In fact, a definite decision on these can only be made if employment opportunities open to existing resources are known. In practice, it is very difficult to specify these opportunities.

The dairy industry on the far north coast, even with available advanced technology, does not appear to be able to efficiently employ resources in the long run. A paper arising out of the study is being published in the *Australian Journal of Agricultural Economics*.

Economics of drought and supplementary feeding of dairy cattle. — This project was suspended after completion of the first stage because of other more urgent commitments of the officers concerned.

Adjustments to former dairy resources — far north coast. — This study was begun and finalised during the year. It examined the present use of resources which have left the dairy industry on the far north coast in recent years. It was found that the rapid decline in the number of dairy-farmers was due to a number of factors, their economic position being only one. Beef production is the main land use replacing dairying and with this change there is an associated decline in the intensity of labour use. Many former dairyfarmers have accepted a lower income as a result but, despite this, consider themselves better off. Non-farm employment has played a part in most increases in income which have occurred.

Irrigation

Richmond Valley pilot irrigation projects. — Data collection and analysis on this project continued throughout the year. Financial results of the farm are available from 1965/66 to 1969/70.

Alternative farm enterprises with irrigation — Darling River system. — Budgets have been prepared for the major enterprises to enable planning of private irrigation development on the Darling River system.

Economics of flood mitigation in the Lower Hunter Valley. — Progress on this project was hindered by lack of an adequate computational model. A suitable model is now available.

Demand for water in cotton production. — This study which investigates, in considerable depth, the problems involved in pricing public water supplies was completed.

Income uncertainty of vegetable production. — As mentioned in last year's report, enterprise budgets were prepared to ascertain farm income and its variability with various enterprises, and management combinations under likely price and yield variation. Methodological difficulties were experienced with the quadratic programming model and it has now been decided to use a modified form of linear programming.

Coleambally Irrigation Area cost-benefit study. — This study of the national and regional benefits and costs from future development at Coleambally has been incorporated in the investigation of the area by an Inter-Departmental Committee.

Horticulture

Prune industry study. — As forecast last year, results of this study have been published.

Wine grape study, M.I.A. — This project, to determine establishment and development cost for M.I.A. winegrapes, has been completed and the results published.

Beef

Beef cattle industry especially in northern N.S.W. — This study referred to in previous years, has been concerned with the build-up of cattle numbers during a pasture improvement programme in the Clarence Valley. Work on the project was suspended because both the officers concerned were transferred.

Decision making by beef producers: Clarence Valley. — This investigation of the economics of spatial diversification in the Clarence Valley through the purchase of alluvial land has been completed and the results will be published.

The study used a simulation model to ascertain the extent of benefits from spatial diversification when intensive use is made of the additional land. Although expected profit increased and the coefficient of variation decreased, the return to additional capital was only 2.7 per cent, less than that on the dryland section of the property. Although spatial diversification successfully overcomes winter-spring feed uncertainties, it appears economically doubtful under present conditions. Suggestions are made for improving the economics of diversification.

Mutton and Lamb

Regional studies of mutton and lamb production. — Substantial progress was made during the year on this continuing project financed by the Australian Meat Research Committee.

The investigation of the impact of the Australian Meat Board's promotion campaign for lamb, referred to last year, is nearing completion. A demand model for lamb consumption has been developed, and preliminary results suggest that promotion does have an effect on consumer price consciousness as the elasticity of demand has increased appreciably since the campaign began in 1966. Further work in this area is in progress.

Also in progress is a study estimating marketing margins for beef, mutton and lamb. Preliminary estimates have been developed and have proved useful in evaluating present and alternative marketing methods. Refinement of these estimates is in progress and an attempt will be made to explain them.

Least cost drought feeding rations. — A formulation of least cost rations for maintaining sheep, both for survival and production, under drought is the objective of this new study. It is being undertaken in co-operation with animal nutritionists in the Division of Animal Industry.

The linear programme developed for use in the study has reached the initial running stage, and already some interesting preliminary results have emerged. The programme is being enlarged to broaden the constraints used in the matrix.

Poultry

Supply response analysis. — This new study aims to develop a supply model of the poultry industry for use in evaluating specific policy proposals such as production control. Initially a model for an individual producer using dynamic linear programming will be developed; then an aggregate model will be constructed. An important aspect of the project will be the determination of a price expectation model for use within the system. A paper resulting from the project so far has been prepared.

Least cost feed rations. — Development and evaluation of least cost feed mixes for growing pullets, using linear programming with parametric variation of the weighing row restraint, is the purpose of this new project.

The computational part of the project has been completed. Results indicate that significant savings, up to 8 per cent, in feed mix costs can be achieved through relaxing the bulk restraint of the weighing row. A paper on this aspect is in preparation.

The second part of the study involves a test of the computer generated rations by feeding them to growing pullets.

MARKETING AND POLICY RESEARCH

Commodity investigations. — The oilseed section of this project, referred to last year, has been completed and supplemented by three additional papers. The interim commodity survey on coarse grains, with special reference to barley, maize and sorghum has also been completed.

Decision making information in the marketing system. — This project will be suspended because the duties of the officer concerned have been changed.

Study of the "cobweb cycle". — Investigations revealed that it would be difficult to obtain a meaningful and useful result; hence the project has been abandoned.

Domestic demand structure for shell eggs. — As mentioned in last year's report, difficulties were experienced because of lack of reliable data on backyard production. It has now been decided to investigate the possibility of developing weekly demand functions to be used in a model of pricing policy for use by the Egg Board.

ADVISORY, EDUCATIONAL AND EXTENSION ACTIVITIES

PUBLICATIONS

The Review of Marketing and Agricultural Economics

This journal, acknowledged worldwide as one of the leading professional journals of agricultural economics, appeared quarterly as usual. It contained 14 articles, including one commissioned review paper. The review paper, the third to be published, was contributed by Professor J. L. Dillon and was titled "An Expository Review of Bernoullian Decision Theory in Agriculture: Is Utility Futility?"

Bulletins and Leaflet Series

Miscellaneous Bulletin series. — Three bulletins were issued during the year while one was being prepared at the close of the year. It is anticipated that this series will continue to provide a most useful outlet for research reports which are too comprehensive or detailed to appear in professional journals.

Farm Planning Leaflets series. — Four in this series were published during the year. The series continues to provide a useful avenue for dissemination of information for use by farmers and their advisors, although it is now only one of numerous forms of regional publications.

Regional publications. — Economists located in regions publish numerous articles and papers within their Region for use by farmers and advisors. In excess of 100 original pamphlets were produced in this manner with some regional economists initiating formal series such as the *Economic Information Series* from the Leeton and Goulburn Economists, the *Wagga Occasional Economics Series* and, from the Maitland economists, the *Economic Notes Series*.

Agricultural Gazette of N.S.W. — Authors in this Division had ten contributions accepted for publication during the year. As at June 1971, five of them had appeared in the Gazette.

Marketing booklets. — The Division again published these booklets relating to the production and marketing of fruit, vegetables, beef cattle and sheep.

EXTENSION SERVICES IN FARM MANAGEMENT

Regional economists. — Two regional economists resigned during the year and two new appointments were made, one to work specifically on sheep industry problems. With the promotion of one other regional economist to Principal Extension Economist there were 15 economist located in regions at the end of the year. The Mid-Western Region is the only region which, at June 30, did not have an economist located within the region.

Extension through mass media. — Regional economists delivered more than 200 lectures and talks to farmers and other people. Approximately 150 original items were produced in handout form. There were 22 press articles, 51 radio tapes and 10 television segments prepared by regional economists.

Schools. — Of three residential schools in farm management during the year, two were for extension officers and one for farmers. In addition there were four short schools for farmers in farm management conducted in regions.

Farm adjustment. — There was general emphasis on farm adjustment during the year. Regional economists provided substantial amounts of valuable information for use by extension officers and farmers on the relative economics of different adjustment possibilities.

The educational farm management groups established last year were continued with participating farmers adopting useful farm record systems and receiving direct training in farm management analysis techniques. This educational project is still very much at a formative stage.

The group records analysis project, also mentioned last year, continued. During the year farm performance figures of 10 groups were analysed. At the end of the year 15 farm record analysis groups were participating in the project. Group size ranges from 6 to 30 participants with a total of 185 farmers participating in the project.

Officers co-ordinating the farm record analysis groups included: four Economists, four Livestock Officers (Sheep and Wool), three District Agronomists, one Livestock Officer (Beef Cattle) and one Extension Officer. Economists located in regions are providing substantial assistance to the non-economist group co-ordinators.

An evaluation of the farm record analysis project is to be undertaken in the 1971-72 year to determine how and to what extent the Department might use such a technique to further improve extension services to farmers.

COLLEGE LECTURING

The long standing arrangement by which the Division provided officers on secondment to agricultural colleges to assist with lecturing in agricultural economics and farm management terminated.

Until his transfer to the college staff in January 1971, one economist continued on secondment to Hawkesbury Agricultural College to undertake lecturing duties. Another Head Office economist continued to provide lectures in the Diploma in Rural Extension Course at Hawkesbury Agricultural College during the 1970 academic year. Up until the end of May 1970, this officer assisted with the lectures in farm management and agricultural economics to the under-graduate students at Hawkesbury Agricultural College.

INTERNATIONAL TRAINING COURSE IN AGRICULTURAL MARKETING

At the request of the Commonwealth Department of Foreign Affairs the Division again organised and conducted the N.S.W. sector of a training course in agricultural marketing for Colombo Plan students. The N.S.W. part of the course was from May 31, to June 30, 1971, and the contents and programme were considered by the 13 students to be generally satisfactory.

A course similar to this was first conducted last year and marked a significant change from the previous procedure whereby Colombo Plan students arrived singly or in small groups and each was given individual training and assistance. The course is not expected to be repeated for another two years.

POLICY ADVICE

With the increasing complexity of the problems facing agriculture the Division is participating to a greater extent in the provision of policy advice to the Department and the Minister; particularly concerning the marketing of various agricultural products and the question of marketing or production quotas to control surplus production.

Specifically the Division has been concerned with marketing and production policies for wheat, eggs, dairy products, sheep meats, cotton and tobacco, and with market prospects for alternative enterprises, especially coarse grain and oil seed crops.

The Division continued to advise on the supply position affecting proposed exports or imports of stock feeds.

The Chief accompanied the Minister and Director-General to all meetings of the Australian Agricultural Council and the Standing Committee on Agriculture during the year.

MARKETING BOARDS AND POLLS

The Division is responsible for the administration of the Marketing of Primary Products Act, 1927, and in particular for the conduct of polls arising from this Act.

The Egg, Lemon, Rice, Tobacco Leaf, Wine Grapes, and Central Coast (N.S.W.) Citrus Marketing Boards, constituted under the Marketing of Primary Products Act, continued to operate and fulfil their statutory obligations.

The Citrus Fruits (Excluding Lemons) Marketing Board for the Shire of Wentworth and that portion of the Balranald Shire within the County of Taila, which was constituted in 1966, showed little activity.

In addition to the above a Grain Sorghum Marketing Board was constituted on June 18, 1971. The Board held its first meeting late in June 1971. It is anticipated that it will market the 1972 grain sorghum crop but it will not handle any part of the 1971 crop.

During the past twelve months, the regulations made under the Act in respect of the Central Coast (N.S.W.) Citrus Marketing Board were promulgated and are now with the Parliamentary Counsel. A number of regulations concerning other marketing boards were also amended during the year. These included general regulations relating to fees and allowances payable to members of Boards.

Six polls were conducted under the Marketing of Primary Products Act. These were:

1. Triennial election of five Producers' Representatives to the Central Coast (N.S.W.) Citrus Marketing Board. (7.8.70)
2. Triennial election of five Producers' Representatives to the Rice Marketing Board for the State of N.S.W. (25.9.70)
3. Triennial election of five Producers' Representatives to the Egg Marketing Board for the State of N.S.W. (10.10.70)
4. Poll on the Question of the Constitution of a Grain Sorghum Marketing Board for the State of N.S.W. (20.2.71)
5. Poll on the Question of the Dissolution of the Central Coast (N.S.W.) Citrus Marketing Board. (6.4.71)
6. Election of five Producers' Representatives to the Grain Sorghum Marketing Board for the State of N.S.W. (15.5.71)

In addition to the above mentioned polls preparations are well in hand for taking of a poll on the question of the constitution of a Barley Marketing Board for the State of N.S.W.

A petition for the establishment of an Oats Marketing Board was also received. As it was not possible for the Division to conduct a poll on this question, the Electoral Commissioner for N.S.W. was asked to and accepted responsibility for conducting the poll.

The poll on the Question of the Dissolution of the Central Coast (N.S.W.) Citrus Marketing Board resulted in a negative vote. Consequently this Board will continue its operations.

MARKETING REPORTS AND RELATED SERVICES

Reporting. — The Division fulfilled a statutory function relative to the Marketing of Primary Products Act, 1927, by continuing to collect and disseminate detailed wholesale market information.

Reports covering supplies, quality, price and price movements, at the City Municipal Markets (fruit, vegetables, poultry, fish, and cut flowers), at Homebush (cattle, sheep and pigs), at Alexandria, Perry Park, and Sussex Street (grain, forage and hard vegetables) were provided each day the various markets traded. Retail prices of certain commodities were also reported upon daily.

Press and radio daily service. — Market information provided by the Division was broadcast daily by the Australian Broadcasting Commission including regional relays and interstate hook-ups, and by some commercial radio stations. The daily press, periodicals, Commonwealth and State government departments and instrumentalities and producer organizations, were furnished with detailed marketing information through the *Daily Wholesale Price Quotations*.

Monthly Surveys. — Monthly surveys of wholesale and retail stockfeed prices and wholesale prices of dressed poultry were continued.

Inter- and intra-state supply trends. — Records of selected arrivals into Sydney by rail, air, and sea, of various primary products from inter- and intra-state sources, were maintained.

General information service. — Numerous requests were received from State and Commonwealth government departments, banks, and private individuals (in Australia and overseas) for information about prices and prospective markets for an extensive range of primary products.

Crop reviews and forecasts. — These services continued. Production forecasts were prepared for wheat, oats, barley, and citrus fruits.

The regular monthly survey of New South Wales *Pastoral Conditions* and the monthly *Report on Production Trends* continued to be published. Publication of *Weekly Marketing Notes* continued unchanged.

ECONOMIC SURVEY OF DAIRY INDUSTRY

An economic survey of the dairy industry as required under the Dairy Industry Authority Act, 1970, is being conducted. It was arranged for the survey to be in collaboration with the Commonwealth Bureau of Agricultural Economics which is currently engaged in an Australia-wide survey of the dairy industry.

Data for the survey are being collected by interviewing farmers on 257 farms in 5 regions of the State and by using income tax and dairy factory production records. Field interviews commenced in May and are expected to be completed by the end of July 1971.

The main aim of the survey is to assess the economic situation of dairy farmers over the three financial years 1967-68 to 1969-70. It will provide information on a regional basis on the distribution of farms by size of dairy herd, cost structure and cost and return relationships, income levels, capital structure and returns to capital and management. The relative financial structure and performance of dairy properties by scale of operation and type of dairy production will be examined together with the indebtedness and credit situation of dairy farmers. When completed the results of the survey will be made available to the Dairy Industry Prices Tribunal and the Dairy Industry Authority.

DIVISION OF INFORMATION SERVICES

INTRODUCTORY

The Services, in Summary

The Division has been concerned with:

- Editing Services
- Research Liaison (Science Writing) Services
- Library Services
- Enquiry and Publications Distribution Services
- Home Gardens Advisory Services (by secondment from Division of Plant Industry)

Some Changes Affecting the Division's Services.

Research Liaison Officer (Science Writing) Positions Suspended

The two Research Liaison Officer positions in the establishment have remained vacant for the year, though well advertised. The Public Service Board ultimately suspended the positions in the course of the State's funds-saving campaign. One had been vacant since 30th April and the other since 8th July, 1970.

The Division's Editor and Assistant Editor sustained the Research Pars segment of the Agricultural Gazette in the absence of a Research Liaison Officer (Science Writing). The Divisional Chief personally assisted some research workers in preparing science material for publication or as theses, but without specialist Research Liaison Officers it was not feasible for the Division to take the initiative and volunteer assistance to research workers.

Transfer of Library Services'/Expenditures' Supervision

Late in June 1971 the supervision of the Department of Agriculture's library services/library expenditures were transferred to the Executive Officer, Agricultural Education Office (Central Administration) by request of the Chief, Division of Information Services (C.D.I.S.). Shortly to enter pre-retirement leave, the C.D.I.S. had sustained these areas of responsibility for some 24 years.

Change in Agricultural Gazette Style, Size and Frequency

A monthly since 1890, the *Agricultural Gazette of New South Wales* became a bi-monthly journal in 1971 — to appear in February, April, June, August, October, December. February 1971 issue was the first in the new system.

The type size for all segments has been reduced to that of the research segment. By this and by including 64 in lieu of the 48 pages per issue as was programmed a year ago, the letterpress contents per year will still be 70 per cent of the quantity intended if 12 monthly issues of 48 pages had been sustained — even though the number of issues per year has been halved.

The changes were provoked by the P.M.G. announcement, in August 1970, of de-registration of government periodicals for transmission through the post at the privileged rates of a newspaper. At that time it was estimated that the de-registration, together with increased postal rates that became effective in October 1970, would increase the *Agricultural Gazette* postal costs per year from roundly \$6,000 to roundly \$40,000.

This potential increase in expenditure was largely countered by halving the frequency of postings, halving the occasions of working the Gazette at the printery, and thereby halving the number of colour-cover blocks and 4-colour printings; whilst the size of each issue was increased to take full advantage of the respective 2 oz–4 oz postage weight/rate scale.

Other costs increased in the meantime. In consequence, and as a further economy-campaign measure, from the April 1971 issue onwards the provision of a 4-colour cover has been suspended, by Government Printer decision. A regretted side-effect is that this also removes opportunity to use the back-cover for publication of 4-colour plates on insect pest life cycles, plant diseases, and the new series on weeds as programmed.

Dairy Topics' Size and Frequency Changed

This former bi-monthly is now a quarterly journal; a change brought about by the P.M.G.'s de-registration of government journals. The reduced frequency to counter the increased postage costs will not of itself reduce the quantity of letterpress per year.

A year ago the programmed intention was to produce *Dairy Topics* six times per year at a 16 page or a 32 page size, dependent on quantity of material available for an issue. In view of the four times per year rate, the maximum has been amended to 48 pages per issue and this still fits the maximum of the particular postage weight/rate scale.

Transfer of Publications Advisory Committee Chairmanship

Again because of approaching retirement of the C.D.I.S., this Chairmanship was transferred late in June 1971. The Director-General transferred the function to the incumbent-elect of the recently established position of Assistant Director-General (Research) in Central Administration. The Research Co-ordinator (Central Administration) will be Acting Chairman from July to September 1971.

The Publications Advisory Committee (P.A.C.): Some Activities

A Register of Publications

The C.D.I.S. as P.A.C. Chairman conducted for this inter-Divisional Committee in 1970 a questionnaire-survey of publications "produced" elsewhere in the Department than the Editing Section, Division of Information Services.

The outcome has been collated as punch-carded data; one card per "publication" (approx. 120) and one card per unit of the Department from which a nil return came. The punch cards comprise a "Register of Publications".

The Register is required by the P.A.C. as a basis for some say in the quantity and quality of publications increasingly produced decentrally, and to help guide a programme for improvement of publications-production resources throughout the Department.

Procedure to Initiate New Lines of Publication

In June 1971 the Director-General approved at the request of the P.A.C. a directive for general distribution in the Department, and inclusion in Manuals/Codes of Operation. The directive defines the procedure to be followed by any unit of the Department to secure approval, through the P.A.C., to initiate a new line or type of publication; e.g. a new periodical, such as a newsletter, or a new series, such as local advisory bulletins.

THE SERVICES

Editing Section

Advisory Bulletins

Although 50 titles were deleted from the range this year, there are now 1,390 numbered Bulletins as against 1,334 a year ago; a net 56 increase.

Of the 140 jobs (excluding stationary and comparable miscellaneous items) sent to the printery, 98 were numbered Bulletins whereas 150 had been the programmed goal. Staff shortages, and replacements requiring diversion of experienced officers' time to induction – and on-the-job training, reduced the production-effectiveness of the section by an estimated 50 per cent. Efforts to intensify the editing, to improve the readability of the advisory literature, also affected the production statistics.

Some 238 publications are in need of printing after revision. Of these, 46 have been revised (by authors) but await editing attention; 21 have been revised *and* edited, and the editing has been checked by authors; 55 are with authors for revision, and 13 that have been revised and edited are with authors to check the editing; and 103 are held in the editing section (though needing author attention) because subject-matter revision at this time would be premature in view of the editing section's current work load.

A year earlier, the respective figures were: 290 needed printing, including 69 revised (by authors) and awaiting editing, 111 with authors for revision, and 110 held in the editing section for more timely submission to authors for revision.

The printery this year delivered 146 publications (97 bulletins; and 49 others comprising a miscellany of annual reports of various units, programmes of special events, prospectuses of institutions, etc., but excluding stationery); as against 143 in 1969/70 and 200 in 1968/69. At June 30, 1971 there were 81 jobs at the printery, as against 96 a year earlier.

Press Releases

As against 101 a year ago, 90 two years ago and 59 three years ago, this year 87 releases passed through the editing section; a seeming halt in the upward trend. Most were Ministerial or Director-General releases.

Dairy Topics

Formerly bi-monthly; now quarterly. — Up to and including the September/October 1970 issue the bi-monthly system continued. A quarterly system started with the January 1971 issue.

The reduced frequency as an economy measure was provoked by the Postmaster General's de-registration of government journals for postal transmission at the rates of a newspaper; a P.M.G. decision that would have increased the annual postal expenditure on *Dairy Topics* by about 600 per cent.

Deliveries. — Five issues (the latest being April 1971) were delivered in 1970/71; and the July 1971 issue has been prepared and is at the printery. This fulfilled the programme, after allowing for the reduced frequency.

Size. — The April 1971 issue was of 48 pages, as against 32 pages in each of the four immediately preceding it. Increase to 48 pages, now the standard, takes full advantage of the minimum postage rate for each copy and yields 192 pages per year from four issues — as would be so for six issues at 32 pages each.

The five issues in 1970/71 averaged 35.2 pages and 14.6 articles, as against the 1969/70 averages of 23 pages and 8.6 articles.

Sources of material. — Of the 73 articles in the five issues, 58 originated in Division of Dairying, two in Division of Animal Industry, three in Division of Information Services, one in Division of Plant Industry, and nine came from external sources — including eight from the Australian Dairy Produce Board.

Mailing list. — The *Dairy Topics* mailing list further declined. At the end of 1970/71 it was about 9,000, as against 10,500 a year earlier. This reflected the lowering total of dairy farms.

Poultry Notes

Four issues of this quarterly were delivered, as programmed. The latest was for April 1971. June 1971 issue is at the printery. The four issues ranged from 12 to 16 and averaged 15 pages. Current circulation approximates 4,500, as a year ago.

Veterinary Notes

Conforming with the programme, four issues of this quarterly were delivered. These included the June 1970 issue delivered in July 1970. June 1971 issue is at the printery. The four averaged 33 pages, as against an average of 37.5 in the previous year. Current circulation is 460, as a year ago.

Agricultural Gazette of N.S.W.

Formerly monthly, now two-monthly. — After 80 years as a monthly, frequency has been reduced to six per year. The Gazette is to appear in February, April, June, August, October, December. February 1971 issue was the first in the new system.

The change was an outcome of the Postmaster General's August 1970 de-registration of government journals for postal transmission at newspaper rates. The potential increase in costs (from roundly \$6,000 to roundly \$40,000 p.a. in postal costs alone) was largely countered; partly by halving per year the number of postings, the number of workings at the printery, and the number of four-colour cover blocks/printings.

Size. — To use fully the appropriate postal weight/rate scale (2 oz–4 oz), the programmed page-total has been restored to 64 pages per issue (384 pages per year on the basis of six issues); as against the earlier-programmed 48 pages per issue (576 pages on the basis of 12 issues per year).

To partly offset the reduction in pages per year the type in the Gazette as a whole has been reduced from 10 point on 11 point to 9 point on 10 point; the size established earlier in the Research Pars segment.

An effect is that although the number of issues per year is down 50 per cent, the year's letterpress contents will be down only 30 per cent.

Colour-covers suspended. — A further saving was forced by the Printer's decision later, after the February 1971 issue was published, to discontinue the four-colour covers introduced in March 1953. For the April 1971 issue a one-colour cover was provided and this will be the policy until improvement in the printery funds position permits otherwise.

Regrettably, the lack of four-colour cover-printing means also no opportunity to publish on the back cover the colour-plate insect pest, plant disease and weed illustrations as programmed.

Deliveries. — Nine issues of the Gazette were delivered in 12 months; almost the programmed goal as amended by allowing for six at monthly intervals from July to December 1970 and three at two-monthly intervals from January to June 1971. But the nine included the June 1970 issue (delivered late), and at 30th June the June 1971 issue was still awaited from the printery.

Timeliness. — Only one of the nine issues in the 12 months appeared from the printery in the nominal month, as against three such in 1969/70. Surprisingly, the change from monthly to two-monthly publication has been followed by deterioration of timeliness. Greatest delay was for the February 1971 issue, the first in the new system. This came from the printery seven weeks after the scheduled "within the first week of the nominal month". April 1971 issue was in turn six weeks late.

Flow of matter. — Revised material from existing Advisory Bulletins had to be used to a total of 29 pages in the 1970/71 volume of the Gazette, because of shortage of new material at the dead-line for respective issues; an improvement on the 47 pages so filled in the 1969/70 Volume.

Flow of research pars. — These averaged 5.3 pages per Gazette issue, comparable with the 5.2 in 1969/70. The pars averaged 6.9 per issue; a seeming improvement on the 5.3 in 1969/70, 4.5 in 1968/69 and 3.7 in 1967/68, but there were three issues less in 1970/71.

Two circulars increased the recent flow of volunteered Research Pars material from research workers. The June 1971 and the August 1971 Gazette, already at the printery, will respectively carry eight and 11 research pars.

Farm home material. — This averaged 4.3 pages over the nine Gazette issues delivered, as against 5.3 over the 12 issues in 1969/70.

Gazette mailing list growth. — Additions and deletions yielded a net increase of 1,264 as against 1,824 in 1969/70, 2,253 in 1968/69 and 3,017 in 1967/68. A total printing of 29,200 copies per issue is now needed. This raises the possibility of the Printer having to re-impose a faster but poor quality printing. This course of printery action was taken earlier, in the late 1950's, when the mailing list had grown to about 37,000. That list had to be reduced in the early 1960's to about 16,000 before the Printer resumed an acceptable quality of presentation. Reproduction of illustrations was especially affected, adversely, in that period.

The Annual Report of the Department to Parliament

The Annual Report of the Department of Agriculture for 1969/70 was produced for tabling in Parliament by 22nd October, 1970. Parliament on that date ordered it for printing. The proofs came to hand on 25th May, 1971, and were checked and returned to the printery within two days. At 30th June, 1971, the printed 1969/70 Report was not yet delivered.

Text Books

Manuscript for the textbook "Miscellaneous Crops" (Kitamura) did not come to hand, so the programmed intention to start this editing job could not be fulfilled.

The future of the incomplete manuscript for the textbook "Insect Pests" (the late P. C. Hely) has been resolved, at least pro tem, by submitting the material to the State Office Block Library. It has been accessioned there for reference uses.

Research Liaison (Science Writing) Service

The two Research Liaison Officer positions in the establishment were vacant throughout the 12 months; one since 30th April and the other since 8th July, 1970. The positions were advertised several times, including interstate, but suitably experienced applicants could not be secured. Late in the fiscal year the Public Service Board suspended the two positions, as a funds-saving measure.

Lacking specialist Research Liaison Officers, the Divisional Chief and the Editor and Assistant Editor helped science writers as needs came to attention, but in light of other duties were unable actively to seek out or initiate work of this sort. Some of the assistance given in particular by the Editor and Assistant Editor is reflected in the sustained Research Pars segment of the Gazette, reported in an earlier paragraph.

Enquiry and Publications Distribution Section

Enquiry Statistics

Excluding the Home Gardens Officers' work, reported in later paragraphs, the enquiry counter office assistants (two) handled 29,677 requests; comparable with the 29,649 total in 1969/70.

In the 29,677 were: 13,883 in-person enquiries (13,341 in 1969/70); 9,454 'phoned enquiries (9,381) and 6,335 by post (6,747). Of the 6,335 postals, 1,409 were urban and 4,926 were rural — as against 1,788 urban and 4,959 rural in 1969/70. No particular trend is indicated by those figures.

Publications Distribution Statistics

The enquiry counter office assistants and a clerical assistants distributed 513,373 items of literature (618,199 in 1969/70). In the 513,373 were: 88,344 direct to the public; 388,711 in bulk-parcelled responses to Regional/District offices, the colleges and other institutions of the Department; 15,321 in applying a "new/revised/reprinteds" mailing list to inform country offices about recent material from the printery; 20,997 in applying a "new/revised/reprinteds" mailing list to service the libraries of various institutions in Australia and overseas.

Sales of Publications

Revenue from this Division's sales of publications approximated \$11,392; as against \$6,610 in 1969/70, \$9,622 in 1968/69 and \$2,362 in 1967/68. An interesting contribution to the total was the approximate \$700 from sales at the Information Bureau during the R.A.S. Show.

Of the \$11,392, the "Pastures" book (Whittet) produced roundly \$4,514, the "Weeds" book (Whittet) \$2,484, and the "Farm Records Book" and components \$476; the remaining \$3,918 was spread over about a dozen titles in the limited range of sale publications.

The "Weeds" (2nd edition) sales total was 740 copies, as against 855 in 1969/70 and 2,057 in 1968/69. In all, 3,652 2nd edition copies have been sold since coming into stock on 14th November, 1968. Of the 740 sold here in 1970/71, all but 194 were at discounts appropriate to the purchasing body.

The "Pastures" (2nd edition) sales total was 1,487 copies, as against 510 in 1969/70 — but the 2nd edition did not come into stock until 28th April, 1970. In all, 1,997 of the 2nd edition have been sold here since that date. Of the 1,487 in 1970/71, all but 185 were at discounts appropriate to the purchasing body.

Home Gardens Advisory Service

Individual Contacts

The Home Gardens Enquiry Officers (2) handled 12,310 home garden, allied and commercial floricultural enquiries. These are enquiries of the type that office assistants in the enquiry section would have difficulty in servicing with literature only; enquiries that would be referred to technical officers elsewhere in the Department if there were not a home gardens staff here.

The 11,310 presented a big increase compared to the 7,635 in 1969/70; 8,666 in 1968/69; and 5,708 in 1967/68. In the 12,310 were 2,065 in-person contacts, 8,657 by 'phone, 1,515 by post and 73 from field officers.

The significant increase was in 'phone contacts; an approximate 76 per cent increase, from 4,928 in 1969/70 to 8,657 in 1970/71. This partly reflects the presence of a second home gardens officer. An inferred probability is that in earlier years thousands of potential enquirers by 'phone were unable to get through to the service on the single line and were thus frustrated.

Lectures and Field Activities

Two evening lectures were provided; one for the N.S.W. Royal Horticultural Society and one for the Arcadia-Galston Branch of the Agricultural Bureau of N.S.W. Two one-day gardening schools were serviced; one for the Nambucca District Branch of the Agricultural Bureau and one for the Blayney Branch of the Country Women's Association. A lunch-hour lecture was given in Hyde Park during the Waratah Spring Festival.

Nine private gardens, the gardens of the Royal Sydney Yacht Squadron, Kirribilli, the lawns at Vacluse House, and several metropolitan commercial nurseries and one at Leura were visited for advisory reasons. Gardener classes at the Ryde School of Horticulture were serviced with a lecture course by H.G.E.O. Mr F. Bagshaw, part-time.

Floriculture Literature

The pressure of attention to enquiries, especially the increased volume of 'phone contacts, deprived the two officers of the time to produce or revise literature. Revisions of "Cultivation of the Waratah", "Camellias" and "Chrysanthemums" are near to complete.

Library Services

Central Agricultural and State Office Block (S.O.B.)

Library Relationships

General. — As recorded in earlier Reports: for the period of Agriculture's domicile in the State Office Block, Phillip Street, the position of Central Librarian, Agriculture, is in effect synonymous with that of Librarian-in-Charge (S.O.B.).

Although the S.O.B. Librarian-in-Charge has been concerned with six departments in the S.O.B., roundly 80 per cent of the funds, the work-force, and the services rendered are for Agriculture. When Agriculture is in due course re-housed at the new, Rawson Place address, an "unscrambling" of S.O.B. Library holdings to retrieve Agriculture's majority-segment will be a major undertaking. This will also leave an appreciable void in the Phillip Street S.O.B. Library.

Staffing. — Eight officers resigned during the year and three were transferred to other Branches of the Library of N.S.W.

The Librarian-in-Charge continued under heavy stress arising from inadequate staffing relative to the State-wide needs of Agriculture; numerically, experience-wise, and continuity-wise. The circumstances may only be properly represented through the N.S.W. Principal Librarian, and have been.

A submission in 1969/70 has yielded an extra library assistant half-time in the S.O.B. Library and half-time in the Branch Library in the Mark Foys Building.

Mooted decentralization of business activities. — It needs to be said, that accommodation in the S.O.B. Library offices could be insufficient for more officers to attend to the business-type activities of the State-wide library services. Partly because of this, an effort is being made to decentralize some of the business activities; e.g. the Colleges of Advanced Education to do their own ordering has been mooted.

Branch Library Visits; and Staffing Problems

The Central Librarian this year visited some but not enough of Agriculture's branch libraries and decentralized literature collections. Purposeful visits were made to the Veterinary Research Station, Glenfield; the Biological and Chemical Research Institute, Rydalmere; the C. B. Alexander Agricultural College, Tocal; the Hawkesbury Agricultural College; the Wagga Agricultural College; the Yanco Agricultural College and Research Station; Leeton Agricultural Research Station; South Western Regional Headquarters, Leeton; and the Royal Botanic Gardens and National Herbarium.

The Deputy Principal Librarian, Library of N.S.W., and a Public Service Board Inspector inspected with the Central Librarian the newly formed Branch library in the Mark Foyd Building (Divisions of Plant Industry and Horticulture, and Biometrical Branch). As a result, a library assistant was appointed on a half-time basis. A similar, group inspection at the Veterinary Research Station, Glenfield, has led to a recommendation to the Public Service Board for appointment of an office assistant/typist to the librarian there.

Appointment of a full-time library assistant and an office assistant/typist to help the servicing of the libraries at the Agricultural College and the Agricultural Research Institute, Wagga, has been recommended. Results are awaited. These libraries have suffered a lot by discontinuity of professional librarianship; the losses of that type of professional have been due in part to shortage of office assistance/typing.

An additional library assistant, but part-time, has been appointed to Hawkesbury Agricultural College. A current recommendation is that this library assistant be full-time, and that an office assistant/typist also be appointed.

Appointment of a clerical assistant to the library at the Royal Botanic Gardens and National Herbarium also has been recommended.

The Central Librarian spent one day, and one of her S.O.B. Library staff spent several days, servicing the library at the Biological and Chemical Research Institute, Rydalmere; pending an appointment there to replace the resigned librarian. Similarly an officer of the S.O.B. Library spent two weeks at the Wollongbar Agricultural Research Station library, organising the transfer of library material to the new Research Building. There is no professional librarian staffing at this now major Station.

Many other centres might well have been similarly served. They needed at least short-term assistance, but the commitments to help cannot be undertaken with the existing S.O.B. Library staff strength.

Fund Allocations for Books, Periodicals, Papers

The C.R. B4 vote for Department of Agriculture was further increased, from \$19,024 in 1969/70 to \$22,500 for 1970/71. There was also \$20,500 from C.E.S.G. funds, as against an appropriation of \$15,000 in the previous year. The two funds were fully committed by January 1971; near to 70 per cent of the total being tied up by standing commitments to subscriptions for periodicals.

The Librarian's ordering office and accessioning services were engaged also in the expending of \$4,894 for the Hawkesbury, \$3,038 for the Wagga, \$1,400 for the Yanco and \$635 for the "Tocal" Agricultural Colleges.

Thus, there was a grand total approximating \$53,000; giving rise to a multitude of pressing business-activities as well as the expected professional librarianship services in the Central Library of the Department of Agriculture in State Office Block. The staff there were under great stress in handling the: checking of sources and availabilities of items; observing expenditure approvals from within the Department; ordering, accessioning, cataloguing and distributing items State-wide; checking and certifying the subsequent accounts from local sources and the N.S.W. Government Office overseas; and so on.

Library Ordering Statistics

Some 3,432 items were ordered, or covered by requisitions, through local suppliers or the N.S.W. Government Offices, London, as against 2,559 in 1969/70. Of the 3,432: some 543 were for Hawkesbury Agricultural College, 439 for Wagga Agricultural College, 254 for Yanco Agricultural College and Research Station, and 156 for C. B. Alexander Agricultural College (a total of 1,392 for the colleges).

For the Departments other than Agriculture in the S.O.B., 194 items were ordered for Public Works, 47 for Mines (which, during the year, became responsible for its own ordering), 23 for Premier's, seven for Local Government and eight for the Treasury.

Library Accessioning Statistics

Central Library statistics only. — Some 29,248 items were accessioned, as against 28,461 in 1969/70. The 29,248 comprised 1,834 books, 18,590 new issues of periodicals, 1,186 annuals and 7,638 pamphlets. The 7,638 pamphlets comprised 3,750 in series, 320 catalogued, 480 distributed by subject, 1,137 Parliamentary papers and 1,681 miscellaneous. Rate of items accessioned averaged 547 per week.

Library Loans Statistics

Central Library. — Loans totalled 41,416 items, as against 36,448 in 1969/70. The 41,416 comprised 10,928 miscellaneous items (response to specific requests) and 30,488 (an average of 586 per week) as current issues of periodicals circulated per standing lists.

The 10,928 miscellaneous items were mainly 8,199 to Departmental officers and 1,500 to libraries of other institutions. Meantime, 2,090 (including 500 photocopies supplied in lieu of loans) were borrowed from other libraries for Departmental officers.

Branch libraries (statistics incomplete). — The total of 36,019 loans within and from Branch libraries is known to be incomplete. Most of the Branch libraries do not have a professional who would maintain the statistical records. But the incomplete total at least signposts a worthy volume of active library usage.

The 36,019 comprised: 6,322 at and from Hawkesbury Agricultural College; 12,574, the Veterinary Research Station, Glenfield; 606, the Agricultural Research Institute, Wagga; 2,268, Wagga Agricultural College; 1,425, Royal Botanic Gardens and National Herbarium; 12,824, the Biological and Chemical Research Institute, Rydalmere.

Library Information Bulletins

Twelve Bulletins were compiled and distributed in 1970/71; totalling 749 pages (quarto) and 6,360 items. The 1969/70 figures were: 11 issues; 515 pages; 5,328 items. Thus there was this year a 45 per cent increase in number of pages and 20 per cent increase in number of items in these widely distributed, informative bulletins about library acquisitions.

Photocopying Statistics

Jobs arranged through the S.O.B. Document Reproduction Centre totalled 1,692 and involved 12,308 sheets; comparable with the total of 1,662 jobs and 11,681 sheets in 1969/70. A notable volume of photocopying (500 jobs) was done also by external libraries in responding to Agriculture's inter-library loan requests.

Reference Work and Literature Searches

Bibliographies produced by literature searches done for officers by request were regularly listed also in the Library Bulletins. Thus the list product of each search became known to many besides the instigating officer. This year 59 search lists were collated, compared to 45 in 1969/70 and 61 in 1968/69.

Literature-search lists, one of the most useful products of professional librarianship, would figure much more strikingly in the statistics if there were enough staff to support a positive stirring of research and extension workers' use of this aid to their effectiveness.

Translation Service

Twenty-one translation jobs were arranged for Departmental officers; from French, German and Swedish literature. More were sought but the requests were withdrawn by officers when the potential costs, in relation to available library funds, were made known.

New Exchanges

New reciprocal exchanges were arranged; this year with further institutions in Brazil, The Netherlands, Thailand and the U.S.A.

DIVISION OF EXTENSION SERVICES

PROBLEMS OF RURAL ADJUSTMENT

Officers of the Division submitted a report and a number of recommendations arising from problems of rural adjustment to the Extension Policy Committee. The recommendations related to the role of extension and the training of extension workers to meet changing economic and social conditions.

The Extension Policy Committee decided that the proposed review of extension services for rural people in N.S.W. should, initially, be in co-operation with other Departments whose operations bear directly on the economic and social conditions of rural people. It proposed an inter-Departmental workshop. The objective would be to recommend a co-ordinated action programme.

In June, a meeting of senior officers of the Departments of Agriculture, Lands, Conservation, and Decentralisation and Development, with the Deputy Director-General, Department of Agriculture, as chairman, decided to proceed with the proposal to conduct an inter-Departmental workshop on problems of rural adjustment.

EXTENSION PROGRAMME PLANNING

A workshop promoted by the staff and students of the course for the Hawkesbury Diploma in Rural Extension, late in 1970, provided an opportunity to examine the major problems that have arisen in three years of extension programme planning. As a result of discussions at the workshop, a number of recommendations about planning procedures were made to the Extension Policy Committee.

The Extension Policy Committee decided: that the programme year be changed from April 1 – March 31 to July 1 – June 30; that industry situation statements, including commodity reports on prospects, be forwarded to Regional Supervisors for distribution to appropriate officers by March 31 each year; that Regional Supervisors be given authority to approve regional extension officers' programmes, but that Divisions retain the right to amend, delete or add to the extension objectives of their own officers; and that reports of extension programme achievements be included as the first section of officers' annual reports.

These decisions were aimed at speeding approvals of programmes and reducing the volume of reports and correspondence.

Generally, further experience in programme planning procedures has resulted in extension officers selecting more meaningful extension objectives. Work methods used to attain them have also improved. Officers within a region increasingly tend to work as a team rather than individuals, achieving greater extension impact.

NATIONAL WORKSHOP ON EXTENSION PROGRAMME PLANNING

Under the aegis of the Standing Committee on Agriculture the N.S.W. Department of Agriculture was given the responsibility for organizing and conducting a National Workshop on Extension Programme Planning. The Workshop was held at the University of New South Wales Administrative Centre, Little Bay, Sydney, from April 19 – 23. It was attended by four representatives from each State, two from the Territory of Papua New Guinea, and one from the Commonwealth Department of Primary Industry.

The purpose of the Workshop was to add to the knowledge, understanding and expertise of all participants in the complex aspects of extension programme planning. It was achieved through the provision of base and background papers, introductory addresses and syndicate and plenary discussions which drew on the knowledge and practical experience of workshop members.

EXTENSION RESEARCH/EVALUATION UNIT

An Extension Research/Evaluation Unit was established in January, 1971. One officer commenced duty in January and a second in March. It had been intended that the unit comprise three officers, but the third appointment has been postponed.

The purpose of the unit is to conduct studies designed to indicate ways of improving the effectiveness of the Department's extension service. The studies will include examination of communication channels and methods within the extension service, within rural communities and between the extension service and rural people.

Three projects have been commenced. One will investigate the sources of information used by farm people and the differences between those farm people reached by the extension service and those that the service does not reach. The second is concerned with the distribution of work time of extension officers between the various aspects of their duties, especially between the various methods used in extension. The third project is intended to assist extension officers to evaluate their own efforts.

It is expected that these projects will have immediate relevance to the selection of extension methods, training of extension officers and improvement of communication within the extension service. In addition, the results will be used in deciding priorities for more specific research projects.

PROFESSIONAL STAFF DEVELOPMENTS

Research/Extension Liaison Officer, Armidale:— An officer was appointed to this newly established position in the Northern Region. He is responsible for liaison between the Department's research and extension workers, appropriate personnel of the Faculties of Rural Science and Agricultural Economics, and the Department of University Extension, University of New England and the CSIRO Pastoral Laboratory at Chiswick. This appointment should improve considerably the flow of research trends and results, and of information on extension needs, between the officers concerned.

Regional Extension Specialists: — The first of these appointments was made in 1969/70, the officer serving the Northern and North Western Regions with headquarters at Tamworth. Additional appointments have now been made for Lismore (North Coast Region) and Goulburn (South Coast and Tablelands Region).

These officers have five main areas of responsibility: extension programming, and use and co-ordination of resources; extension evaluation; development of voluntary groups as extension agencies, for example, branches of the Agricultural Bureau; development of extension officers' skills in the methods, channels and equipment of extension; and extension/research liaison.

Communications Liaison Officer:— The appointment of an officer to the newly established position of Communications Liaison Officer has been approved. The officer will be responsible for the production and publication of a quarterly journal on extension and extension methods; attention to overseas and interstate agriculturalists visiting New South Wales, as individuals and in groups; the development and promotion of extension and educational programmes on rural television; training on other aspects of communications; and the production and/or editing of press articles, notes and letters required by the Minister and members of the Executive on extension matters.

DEVELOPMENT OF OFFICERS IN AND FOR EXTENSION SERVICES

Practical early experience:— In-service development of "officers in training" continued in all regions. The system gives a young officer a minimum of six months intensive training in one or more regions. Under the guidance of the Regional Supervisor, he is placed with experienced personnel of other subject matter divisions, as well as those of his own division. He is given instruction and actual experience in all aspects of extension work and of country office administration procedures.

Extension Service/Methods School: — The annual in-service training Extension Service/Methods School was conducted at Hawkesbury Agricultural College. The school was residential and of 10 days' duration. It was attended by 40 officers, including two Rural Youth Supervisors and a Liaison Officer from CSIRO. The school this year aimed at a maximum of student participation. Lectures were cut to a minimum. Most of the sessions of the school were conducted as small group discussions and tutorials. The changes in learning methods were well received by the officers who attended.

The Division also provided sessions on extension principles and methods at schools promoted primarily for other purposes by various divisions and branches of the Department.

Regional workshops:— Regional workshops designed to improve officers' skills in extension methods were held in the Northern, North Western, South Western, Southern and South Coast and Tablelands Regions. Subjects were: programme planning; aspects of sociology as applied to extension; and communications.

University and college studies:— One officer of the Division was awarded the degree of Bachelor of Arts, University of New England. Two others are continuing studies towards similar degrees. Another officer is undertaking a M.Sc. course at the University of New South Wales, having been awarded a Wool Board Scholarship last year. Another officer of the Division is currently undertaking the course for the Diploma in Rural Extension at Hawkesbury Agricultural College.

Higher grades examinations:— The Public Service Regulation 126 higher grades examination on agricultural extension for officers of this Department and of the Rural Youth Organisation, Department of Education, was set and marked by the Divisions's Principal Extension Officer.

In-service training committee:— A conference of Regional Supervisors decided to form a committee to review in-service training for extension officers. Representatives of other Divisions concerned with extension were later added to the committee. The task set for the committee was to review all aspects of in-service training for extension workers and to make proposals for continuing and relevant in-service training programmes that will assist them to maintain a high degree of professional competence, effectively plan and execute extension programmes and derive personal satisfaction from their efforts.

REGIONAL SERVICES

STAFF

At June 30, 1971 there were 493 officers of the various Divisions of the Department within the nine Regions and under Regional Supervisors' administration for advisory, regulatory and allied services. A further 42 positions were vacant. The total, including the vacant positions, was 535, an increase of 17 for the year.

The Department's personnel at Research Stations and Agricultural Colleges and the veterinary personnel are not in that total. They are separately administered systems. But the total 535 does include 101 officers (3 positions vacant) in clerical and office assistance categories.

REGIONAL ADVISORY COMMITTEES

The Advisory Committees, one per Region, appointed by the Minister to be representative of primary industries and areas within the respective Region, continued to function actively. They offered ideas, recommendations and comment on matters affecting the Department's extension and research activities.

The Minister attended Advisory Committee meetings in several of the Regions.

MASS AND GROUP MEDIA

Use of press, radio and television and purposeful participation with farm organizations in staging group activities — schools, courses and field days — continued to enhance the Department's extension effectiveness and public image.

In the nine Regions there were 2,152 formal publicity releasees for use by press, radio and television, 6,007 radio broadcasts, 89 telecasts, 121 schools or courses for rural people, and 356 field days.

In addition to the 2,152 formal press releases, special feature articles were supplied for the considerable number of newspaper supplements produced by rural newspapers. Similarly, the many meetings of Agricultural Bureau branches and other farmer organizations attended by field officers for talks, discussions and film or slide screenings are not accounted for in the figures.

SOME NOTES FROM REGIONAL SUPERVISORS

MID COAST AND HUNTER REGION

Extension under Drought Conditions

The year began with all districts in the Region declared drought-stricken. As well as being dry, the winter was extremely cold with record frosts. Beef cattle areas were some of the worst affected.

These conditions caused the District Livestock Officer (Beef Cattle), Maitland, to revise his extension programme to concentrate on assisting to deal with the drought situation. The preparation of three pamphlets on drought strategies and management were given high priority in the work plan. As the drought situation worsened, three editions totalling 13,000 copies of the three pamphlets were produced. Some were diverted for use in drought-stricken areas in other Regions.

In addition to the printed information, the drought extension programme included schools, field days and meetings.

Farmers in the Region appeared to handle this drought far better than previous droughts. At its height some graziers were turning off prime stock. There seems little doubt that the use of "backstop" feed lots as a drought measure has accelerated the introduction of lot feeding as a regular management practice. To meet increased interest, a school on lot feeding was organized at Muswellbrook in June. It drew a capacity attendance of 300.

Economists and Extension

The appointment in March, 1970 of two Economists to the Region generated marked improvement in the application of farm management economics in extension. Initially, their greatest influence was with staff at Regional headquarters, with whom they were in regular contact. However, their activities quickly spread to all districts in the Region with beneficial results. Their work has included consultations with District Dairy Officers on milk production costs, surveys of costs of production in other enterprises and close liaison with extension officers working with farm records groups.

The work of the two Economists has been particularly important at a time when agriculture is undergoing such tremendous changes.

Extension Communications

Planned work of the Regional Publicity Officer has been largely directed towards assisting officers produce quality communications relevant to their extension programmes.

The allocation of prime listening time for rural broadcasts by Taree commercial radio, and the high rate of acceptance by the press of news and feature articles by extension officers, have indicated an improved standard of mass media use.

A more imaginative use of visual aids at schools, meetings and field days also helped to increase the effectiveness of extension.

MID WESTERN REGION

Regional Supervisor – Appointment

B. H. Clinton, Livestock Officer (Sheep and Wool), Dubbo, commenced duties as Regional Supervisor, Mid Western Region, Cowra, on October 12, 1970, vice F. J. Nicholson (deceased). Prior to this appointment, during Mr Nicholson's illness, the Region had been administered by H. T. Harrison, Regional Supervisor, Orange, for a period of almost 12 months.

Farmers Diversify to Stay in Business

Traditional agriculture of the Region is facing an economic crisis. Returns for wool and lamb have declined to a level where profitability was marginal. Income from wheat, the other major agricultural enterprise of the Region, has been cut because the imposition of production quotas caused farmers to reduce the acreage sown.

To remain in business, farmers are turning to alternatives which, in the short term at least, appear to have reasonable prospects. Beef, pigs, oilseed and cereal crops other than wheat are rapidly substituting for the traditional wheat and wool agricultural economy of the area.

The area sown to wheat fell from 2,300,000 acres in 1968/69 to 1,800,000 acres in 1970/71. During the same three years the areas sown to alternative crops increased: rape seed from nil to 12,000 acres; sunflower from 60 to 6,000 acres; linseed from 2,000 to 12,000 acres; and barley from 60,000 to 75,000 acres.

Sheep numbers in the Region increased by 15 per cent from 1968/69 to 1970/71. During the same period beef cattle increased by 69 per cent and pigs by 25 per cent.

The increase in sheep numbers continued despite economic difficulties being experienced in the industry. The rise during the past year was largely unintentional. Farmers were reluctant to sell surplus sheep because prices were low and the demand for wool cutters was at an all time low. However, if wool prices remain low, and are not subsidized, a sharp reduction in Merino flock numbers can be expected.

NORTHERN REGION

Campaign Publicity

The Regional Publicity Officer, Northern Region, has developed a system for more effective extension publicity. The system provides for a more intensive and detailed treatment of certain selected subjects than the normal method of handling extension and information material. It involves intensive use of radio supported by press and, where applicable, television. Group extension activities may also be co-ordinated with the campaigns. The subjects selected for campaign treatment are directly related to extension officers' programmed objectives.

Extension/Research Liaison

The appointment of an Extension/Research Liaison Officer at Armidale will have an important bearing on the development of formal and informal liaison in the North and North Western Regions. Already closer relationships have developed between extension officers and research workers at the University of New England and CSIRO.

NORTH COAST REGION

Liaison Between Extension & Research

Conferences between extension and research officers in the North Coast Region in early winter and late spring each year are ensuring excellent working relationships. Originally, liaison conferences were established for agronomists only. Subject matter has now been broadened and conferences now include livestock officers, economists and dairy officers, in addition to agronomists.

To ensure liaison between extension and research workers in horticulture, a conference of extension and research fruit officers is held in late spring and a general conference of all horticultural officers, including Inspectors Plant Diseases Act, in the late autumn each year.

Rise in Beef Cattle Numbers

The percentage of beef cattle in the total cattle numbers in the North Coast Region continued to rise. Every shire in the Region had a higher percentage of beef cattle in March 1970 than in the previous year. Beef cattle in the Region outnumbered dairy cattle by almost two to one. The increase in the percentage of beef cattle has been greatest in traditional dairy shires such as Tweed and Gundurimba. The lowest percentage of beef cattle in any one shire in March 1970 was 42 per cent in Byron.

NORTH WESTERN REGION

Development of New Enterprises

Lower returns from sheep, drought and the development of markets for grain sorghum and oilseed crops have caused major changes in agriculture in the Region.

Over 350,000 acres of grain sorghum and 150,000 acres of sunflowers were sown in the Region in 1970. This was about double the previous sorghum acreage and many times greater than previous sunflower sowings. In addition, many farmers were trying small areas of other coarse grains, oilseed and vegetables.

Because of lack of experience and information in the area, guidance for the development of these new enterprises has depended largely on the initiative of regional extension officers. Results in 1970/71 indicated that diversification of agriculture in the Region will continue.

In addition to the diversification into new crops, there has been a major swing from sheep to cattle. Unfortunately, the drought in 1970 and 1971 posed a major problem in maintaining income from cattle.

Extension Through the Regional Press

Irrigation supplement. — The production of special supplements in regional newspapers to deal in depth with items of particular significance has been an important aspect of regional use of mass media for many years.

A special Irrigation Supplement was prepared for the Moree newspaper this year to provide timely advice about the economic development of the 150,000 acres to be irrigated from Copeton Dam and to help avoid costly initial mistakes. In addition to achieving wide local distribution, the supplement attracted attention elsewhere. At the end of June, 1971, the newspaper was still receiving requests for copies from overseas countries. Twelve thousand copies were printed. Over 500 copies were sent to the United States mainly at the request of the United States Department of Agriculture. The Supplement was entered for the Sommerlad Award.

Weekly agricultural features: — Regional officers maintained a regular weekly agricultural feature in local newspapers in the four major centres in the Region. The "North West Champion" at Moree gained a Sommerlad Award for the weekly agricultural feature, largely serviced by the officers stationed at Moree.

Well prepared weekly agricultural features appear to achieve greater impact with farmers, and to have more value in extension, than the piecemeal presentation of press releases.

Appointment of Livestock Officer (Pigs)

The appointment of a Livestock Officer (Pigs) met a longfelt extension need. There are now 65,000 pigs in the Region and the industry is making a significant contribution to rural income. It is expected that the industry will continue to expand in inland cropping areas, based on grain feeding and cheap sources of grain.

SOUTH COAST AND TABLELANDS REGION

The Rural Situation

The financial position and morale of many tablelands graziers reached a low ebb due to the continued downward movement of prices of wool, mutton and lamb, coupled with the deteriorating season into the 1971 winter. Rising wages, increased rates and higher living costs further aggravated their situation.

On the other hand, beef prices have remained buoyant and future prospects for cattle are bright. The opportunities for supplementing income from crop production on the tablelands are promising. On the coast, dairy production has been maintained at a satisfactory level.*

The Region's extension services are concentrating on lifting morale, helping producers adjust enterprise skills to conform with price trends, emphasizing the importance of quality and the advantages of contract selling, and warning graziers of the adverse consequences of neglecting to maintain one of their most valuable investments – improved pastures.

Crops Workshop

A two-day workshop to study all aspects of crops considered to have potential for commercial production on the southern tablelands was held at Canberra in June, 1971. The workshop was promoted by the Southern Tablelands Research/Extension Liaison Committee. The need for the workshop arose from rising interest in crop production to offset lower incomes from wool.

The crops studied fell into 4 groups – cereals, oilseeds, grain legumes and miscellaneous. Papers, were presented giving technical information, economic data, genetic adaption and market prospects for each of the 18 crops studied. Syndicate discussions followed each set of papers, and collated reports were prepared on each crop group. The workshop indicated that, in the short term, crops with most promise would be barley, lupins, rapeseed and sunflower.

Appointment of Assistant Principal Extension Officer

An Assistant Principal Extension Officer was appointed to the South Coast and Tablelands Region, Goulburn, in October 1970. The officer immediately instituted a programme aimed at: helping extension officers find solutions to their problems in extension; assisting and guiding officers with their extension programmes, including the evaluation of objectives, evaluation surveys and the definition of barriers to the achievement of objectives; developing group extension skills; defining problems requiring research; and maintaining a satisfactory level of extension/research liaison. The officer appointed was able only to initiate this important programme as he resigned from the Department in January, 1971. It is anticipated the position will be filled early in the new financial year.

SOUTHERN REGION

Alternative Crops to Wheat

As in other regions, farmers in the Southern Region displayed a strong interest in possible alternative crops to replace wheat acreages cut by quotas. The Regional Supervisor and district officers organized several field days on alternative crops at the request of the Legume Committee of the Wagga Branch of the Riverina Coarse Grain Growers' Association. One was attended by more than 300 people. The Regional Supervisor, on behalf of the Association, also organized a Lupin and Field Pea Seminar. The objective was to pool knowledge and experience gained from research carried out throughout the Commonwealth into both these crops. Representatives of the Universities of Western Australia and Sydney, CSIRO, the State Departments of Agriculture of South Australia, Victoria and New South Wales, private consultants, farmers' organizations, industry attended, as well as local extension and research workers. Meetings of farmers following the seminar drew attendances of almost 400. Demand for the proceedings of the seminar from throughout the Commonwealth far exceeded the initial issue of 600 copies. A second edition is planned.

Document Reproduction Centre Established at Wagga

The Public Service Board and Department of Public Works established a document reproduction centre in the government offices at Wagga. Among other functions, it is capable of high-class roneoing, collating, book covering, stapling, and presentation of good quality publications. The service has been a valuable aid to extension officers.

SOUTH WESTERN REGION

Code of Operations

Officers in the Wentworth and Balranald Shires were incorporated in the South Western Region in November, 1970.

Chemical Weed Control Guide

A comprehensive, 55 page, "Chemical Weed Control Guide" was prepared for publication by the Irrigation Research and Extension Committee. (I.R.E.C.). Weed control recommendations for most irrigated crops, including fruits, were presented in tabulated form, together with other information needed for correct use of weedicides. Almost 5,000 copies were mailed to farmers.

Extension Campaigns

Three major extension campaigns were conducted during the year in co-operation with I.R.E.C. They were designed to achieve greater production of wheat with biscuit flour quality, and to improve efficiency of production of oilseeds, coarse grains and rice. The programmes included extensive use of mass media and group extension activities. The I.R.E.C. grain crops sub-committee includes several young farmers whose enthusiasm and farming ability are tremendously stimulating to research, extension and other farmers. Improvement in growing techniques with better stands and increased yields in 1970/71, was due in part to co-operative extension between I.R.E.C., the Coarse Grain Growers' Association and district agronomists.

WESTERN REGION

Irrigation Development

The remaining group of off-river irrigation schemes in the Narromine—Trangie—Nevertire area was completed in June 1971. The Narromine—Trangie project involves 95 irrigators each with licences for 200 acres of irrigation, and the Trangie—Nevertire project 64 irrigators each with 200 acre licences. The Buddah Lake scheme commenced operations during the 1970 winter and the Warren-Nevertire scheme was in operation earlier.

Irrigators in these areas, like most producers in the wheat belt, are looking for possible alternatives to wheat. Increased livestock production, particularly beef cattle, has stimulated interest in pasture improvement and fodder crops. It has also opened up opportunities for the utilization of surplus grain as supplementary feed to ensure turn-off of quality stock.

Pig production is also receiving serious attention from graziers and farmers searching for economic alternatives to grain and sheep production.

Extension Changes

Extension officers have decided to further develop group extension. The development will be with both formal and informal groups. Show societies, industry groups and producer organizations are actively seeking to develop educational activities which have received little attention in the past. It is pleasing that this change is occurring mainly in areas where group activities have been limited previously.

AUDIO VISUAL AIDS SECTIONS

FILM AND PHOTOGRAPHIC SECTION

Field Officers 35mm Photography

Some 19,000 photographs by extension officers passed through the photographic aids section for processing and return as 35mm slides for extension use. The total was almost the same as in the previous year. It comprised about 13,900 colour diapositives and 5,100 black and white, compared with 11,260 colour and 7,653 black and white in 1969/70. The increase in the use of colour continued the trend of the past several years.

Twelve field cameras to replace obsolete equipment were issued to regional offices.

Special Purpose Photography

The photographic aids section made 3,217 prints and enlargements as against 2,452 in 1969/70. Most of the prints were to illustrate publications but some were for use in displays. A total of 643 photographs were taken for special purposes by the section.

Some of the special assignments undertaken were: colour photography of weeds in the Lithgow and Bathurst districts for a special weeds publication; photographic itinerary involving the Department's wheat research establishments; a series on hydatids in the South Coast and Tablelands Region; the opening of the research Laboratories at Wollongbar and Seven Hills, as well as photography for the various displays and exhibits in which the Department was involved.

Cine Film Production

In conjunction with the District Livestock Officer (Pigs), Grafton, the section produced a short black and white film entitled "Pig Raising on Slatted Floors". It was released as a silent film for extension use by livestock officers.

Cine Film Library

Programmes collated and forwarded to country officers for local screenings totalled 172 as against 169 in 1969/70.

DISPLAY/DESIGNING SECTION

A temporary display was designed, prepared and erected for the R.A.S. Show in 1971. It replaced the display destroyed by fire in June, 1970.

The section prepared finished art work for: the annual careers exhibit, the annual poultry field day at Hawkesbury Agricultural College, the North Coast National Show, the Orange National Field Days, and the Rotary International Convention.

One of the two officers in the display designing section resigned during the year, and because of economic stringencies, was not replaced immediately.

RADIO SECTION

Radio Interviews by Specialist Officers

Interviews were recorded with 140 specialists of the Divisions of Animal Industry, Plant Industry, Horticulture and Extension Services, and of the Biological and Chemical Research Institute. The tapes were for use mainly by regional officers but a number of recordings were provided direct to the A.B.C. and commercial broadcasting networks.

Taxation Officers' Advisory Tour

Interviews were recorded with 22 officers of the Taxation Department. They were distributed through country radio station networks prior to visits to country centres by these officers to advise on taxation returns.

"Champion Wheat Farmer of the Year" Competition

A network of nine country radio stations, covering five of the Agricultural Regions, again presented the "Champion Wheat Farmer of the Year" Competition with Departmental co-operation. The Extension Officer (Radio) was liaison officer between the network and the Department and all tapes used in the five-minute daily sessions were provided by the Department.

Extension Aids Equipment

New extension aids equipment, including 16mm projectors, 35mm cameras and automatic 35 mm projectors, was purchased for use by extension officers.

THE AGRICULTURAL BUREAU AND ALLIED GROUP ACTIVITIES

BRANCHES OF THE AGRICULTURAL BUREAU

Affiliation of Branches

The number of branches of the Agricultural Bureau of New South Wales affiliated financially with their advisory Council in 1970/71 was 121, ten more than at June 30, 1970. The increase was due largely to the re-affiliation of some branches formerly in recess.

Two new branches were formed; Coolabah branch and the Manildra and District branch.

The small branches at Cobargo, Mount George, Munyabla, Rye Park and Tumbi Umbi ceased to function. The members of Rye Park and Tumbi Umbi joined larger branches in their areas.

Membership

Branch members for whom an affiliation fee was paid to June 30, 1971, totalled 6,906, a decrease of seventy on the previous year.

Trends in Branch Activity

Changes in the outlook for agriculture were reflected in activities of branches. Activities concerned with beef cattle increased from thirteen in 1969/70 to thirty-two this year. Alternatives to wheat were investigated much more fully than in the previous year; a total of 21 functions on this subject were reported.

The number of sheep and wool schools increased slightly; some of them were designed to examine the future prospects of the industry.

THE STATE ADVISORY, REGIONAL AND DIVISIONAL COUNCILS OF THE BUREAU

State Advisory Council

Each of the Agricultural Bureau Regions was represented on the State Advisory Council. Four Council meetings were held with an average attendance of eighty-five per cent of Council membership. The Council held a number of discussions on ways in which the Agricultural Bureau should be involved in helping to alleviate the economic problems of primary producers. Its 1971 State Conference, to be held in Canberra in July 1971, was planned on the theme of "rural reconstruction and adjustment".

Forty-sixth State Conference — The forty-sixth State Conference of the Agricultural Bureau was held at the Hotel Florida, Terrigal from 7th–9th July, 1970. It was officially opened by His Excellency, the Governor of New South Wales. The programme concentrated on the future of primary industries, with accent on markets and market prospects. The Conference was attended by eighty-eight delegates representing forty-three branches.

External affiliation. — The Agricultural Bureau Advisory Council continued formal affiliation with the Primary Industries Council of New South Wales; Rural Youth Organization; Water Research Foundation; Australian Association of Adult Education; Post-Graduate Foundation in Veterinary Science; Bush Nursing Association of New South Wales; and the Associated Country Women of the World.

Regional and Divisional Councils

Currently, Regional and/or Divisional Councils are active in five Regions. Activities sponsored by them this year included:— The Mid Western Regional Convention at Condobolin on "Subsidies and Tariffs" (one hundred people attended); a South Coast and Monaro Beef Cattle Forum at Berridale (114 people attended); and the Richmond Tweed Division's two-day Machinery Field Day at Lindendale with a total attendance of 1,000 people. The Clarence Divisional Council sponsored three lectures by Professor Lascelles, University of Sydney, on "Vaccination Against Mastitis". The Council also sponsored a lecture on "Mining and Legal Rights of Landholders" (forty-five people attended).

The Beef Cattle Breeders' Competition 1970/71

The Rural Bank of New South Wales and the Department of Agriculture again co-operated with the Agricultural Bureau to conduct this Competition. There were 136 entries (152 entries in 1969/70 and 107 entries in 1968/69). The Competition was won by D. R. and A. K. Lang, "Pine Lodge", Tocumwal. Second place went to W. P. Hepburn & Sons Pty Ltd of Ballina, and third to W. T. Payne, "Benoni", Nundle.

Field days held in conjunction with the District and State judgings continued to attract beef cattle producers, accenting the extension value of this Competition.

AGRICULTURAL BUREAU SCHOOLS AND COURSES FOR FARMERS

Through its branches and Regional Councils, the Agricultural Bureau of New South Wales conducted fifty-six schools and courses for farmers, compared with 109 in 1969/70, 93 in 1968/69 and 95 in 1967/68. Agricultural Bureau branches also sponsored 19 schools for homemakers organized in association with the Women's Extension Service.

Officers of the Department of Agriculture were still the more frequent lecturers at Bureau schools and courses, but many speakers were drawn, as in the past, from other State and Commonwealth Government Departments, from Universities, both intra and interstate, as well as from industry and commerce.

The Agricultural Bureau schools recorded were as follows:— (attendance figures are in brackets):—

Beef Enterprise Schools

Feeding — 1: Merriwa (80); *Management* — 9: Berridale (114); Bingara (38), Braidwood (20), Coleambally (42), Gilgandra (45), Walgett (26), Goodooga (80), Warialda (70), West Wyalong (65). *Changing from Sheep to Cattle* — 1: Young (30).

Sheep Enterprise Schools

Future of wool — 3:- Boorowa (80), West Wyalong (28), Goulburn, two days (200). *Lamb versus Wool* — 1: Braidwood (25) *Fertility* — 1: Grenfell (20). *Wool* — 1: Queanbeyan (60)

Pig Enterprise Schools

Pig raising — 2:- Narromine (125), West Wyalong (17). *Nutrition* — 1:- West Wyalong (29).

Pasture and Fodder Enterprise Schools

Weeds — 1:- Braidwood (31). *Agronomy for Beef Production* — 1:- Macksville (40). *Fodder Conservation* — 1: Milton (25).

Cropping Enterprise Schools

Rapeseed — 1:- Goulburn (60). *Oilseed Crops* — 5:- Dalgety (75), Forbes (70), Queanbeyan (35), Cowra (115), Goulburn (25). *Summer Crops* — 1:- Cowra (60). *Dryland Crops* — 1:- Condobolin (70). *Alternatives to Wheat* — 1: Coonabarabran (30).

Agricultural Engineering Schools

Welding — 3:- Murrumbidgee (16), Wadeville (14), Boorowa, two days (22). *Machinery Design and Economics* — 1: Parkes (17).

Farm Finance/Management Schools

Farm Management — 4:- Cowra, two days (23), Inverell (65), Braidwood (30), Moree (60). *Property Development* — 2:- Wyong, a course of six evenings (80), Macksville (35). *Rural Finance and Wool Marketing* — 2:- Coolabah (65), Goolooga (60). *Rural Finance and Business Management* — 1:- Cootamundra, a course of four evenings (80).

Other Schools

Supplementary Feeding — 1:- Wyallda (75). *Drought Feeding* — 1:- Moree (150). *Meat Marketing* — 2:- Coonabarabran (220), Cootamundra (160). *Common Market* — 1:- Braidwood (40). *Subsidies and Tariffs* — 1:- Condobolin (100). *Investment on Stock Exchange* — 1:- Dubbo, two days (30). *Future for Agriculture* — 1:- Inverell (11). *Lemon Industry* — 1:- Arcadia (80). *Soil fertility* — 1:- Narrabri. *Zoonosis* — 1:0 Braidwood (90).

OTHER SCHOOLS AND COURSES FOR FARMERS

Besides the group activities conducted by the Agricultural Bureau and the Women's Service the Department's extension services conducted sixty-five other schools for farmers — either at rural centres or at one or other of the Agricultural Colleges. The recorded schools were as follows (the figure in brackets indicating the attendance) —

Livestock Management Schools

Beef Feedlot Feeding — 1:- Muswellbrook, two days (305). *Beef Cattle Management* — 4:- Casino, two days (80), Oberon (160), Temora (100), Ganmain (60). *Pig Raising* — 2:- Tottenham (26), Grafton (25). *Sheep Blowfly* — 1: Yass (9). *Beef Cattle Feeding* — 1:- Yass (35). *Drought Feeding* — 2:- Tenterfield (75), Uralla (75). *Formulating Rations* — 1:- Wauchope (70). *Merino Breeding* — 1: Cootamundra (35). *Merino Breeding and Structure* — 1: Cootamundra (27).

Crops and Pasture Management Schools

Rapeseed — 3:- Yass (25), Crookwell (65), Taralga (45). *Lupins* — 2:- Inverell (40), Yass (30). *Noxious Weeds* — 2:- Wollongbar (60), Grafton (80). *Pastures* — 2:- Liston (49), Hay two days (80). *Fodder Production* — 1: — Gloucester (55). *Oilseeds* — 1: — Yass (30). *Ricegrowing* — 3:- Deniliquin (60), Tullakool (20), Jerilderie (65). *Summer Crops* — 1:- Oaklands (60). *Alternatives to Wheat* — 1: Manilla (35).

Farm Economics Schools

Farm Management — 2:- Tamworth (14), Wagga (50). *Vegetable Marketing* — 1:- Maitland (80). *Staying in Dairying* — 1:- Murrumbidgee, two days (120).

Agricultural Engineering Schools

Controlled Atmosphere Storage of Fruit - 1:- Orange, two days (120). *Rural Safety* - 3:- Finley (20), Griffith (65), Tullakool (15). *Maintenance Firefighting Equipment* - 3:- Junee (16), Lockhart (20), Ladysmith (18). *Oxywelding and Heating* - 2:- Bigga (19), Tooma (22). *Machinery Maintenance* - 1:- Wagga (34). *Bore Screen Usage and Construction* - 1:- Wagga (30).

Other Schools

Milk Quality - 1:- Wollongbar, two days (80). *Fruit Packing* - 2:- Uralla and Kentucky, two days (21), Young, two days (30). *Viticulture* - 1:- Griffith, three days (200). *Mastitis Control* - 6:- Taree (15), Hannan Vale (13), Oxley Island (13), Coopernook (25), Kendall (22), Landsdowne (12). *Dairying on North Coast* - 1:- Lismore (80). *Professional Assistance for Farm Managers* - 1:- Tocal (24). *Animal Health* - 1:- Nowra, two days. *Crops and Livestock* - 1:- Glen Innes, two days (48). *Timber* - 1:- Murwillumbah (80). *Irrigation* - 1:- Grafton, two days (50). *Supplementary Feeding of Dairy Cattle* - 1:- Gloucester (45). *Woolclassing* - 1:- Goulburn (30). *Soils and Botany* - 1:- Yass, a course of five evenings (160).

SCHOOLS FOR RURAL WOMEN

The Women's Service organized 26 one-day schools compared with 24 in 1969/70 and 23 in 1968/69. Of the 26 schools 19 were conducted in association with branches of the Agricultural Bureau, the other 7 were with branches of the Country Women's Association. Distribution of the schools and attendances were as follows:

Gardening and Landscaping - 8:- Blayney (80), Coonabarabran (42), Dooralong (35), Dunedoo (35), Gouldsville (70), Inverell (47), Manildra and District (15), Nambucca District (72). *Cooking with Lamb and Wine*:- Braidwood (54). *Home Freezing of Foods*:- Forbes (86). *Hair Care*:- West Wyalong (32). *Skin and Beauty Care* - 3:- Bobadah (51), Braidwood (40), Condobolin (17). *Skin Care and Make-up*:- Condobolin (28). *Pattern Adjustments*:- Arcadia (15). *Basic Floristry*:- Far South Coast (38). *Voice, Speech and Personality*:- Springwood (24). *Deportment*:- Purlawaugh (45). *Personality with Poise*:- Purlawaugh (34). *Antiques*:- Forbes (42). *Furniture Remodelling*:- Condobolin (51). *Home Furnishing and Decoration* - 2:- Bobadah (26), Cowra (10). *Living and Pleasure*:- Wyong (36). *Wardrobe Planning*:- Bowral (58).

The CSIRO, N.S.W. Department of Public Health, Australian Gaslight Company, Australian Dairy Board, Australian Fruit Board, Meat and Allied Trades Federation, Sydney Building Information Centre, Sydney County Council, Wool Board, Horticultural Society of N.S.W. and a wide range of authorities, associations and trade organizations continued to assist the Divisions's promotion of extension services for rural women.

OTHER MEDIA OF WOMEN'S EXTENSION SERVICE

Individual Enquiries:- Over 1,000 individual enquiries and requests for information were handled either by letter or telephone.

Radio and Press:- The 26 press statements prepared were mainly concerned with the organization of schools; three were general releases. Of the 89 radio tapes prepared, 26 were on single topics and the remainder were in 9 series.

COMMONWEALTH EXTENSION SERVICES GRANT

The Chief, Division of Extension Services, is responsible to the Director-General for administration of Commonwealth Extension Services Grant funds made available by the Commonwealth through the Department of Primary Industry to enhance extension services and applied research.

For 1970-71 the allocations for the various projects aggregated \$1,104,189 as against \$1,078,011 in 1969-70.

The following table comparing 1969–70 and 1970–71, lists the projects and allocations:

Project	Title	Allocation 1969–70	Allocation 1970–71
501	Research Officers	88,300	141,000
502	Extension Officers	183,400	225,843
503	Field Assistants	120,300	160,000
504	Technical and Laboratory Assistants	47,800	77,000
505	Equipment for Officers	70,020	119,230
506	Motor Vehicles	23,700	53,200
507	Buildings	372,261	92,313
508	Agricultural Trainees	28,000	28,000
509	Extension Aids	20,270	35,822
510	Library Services	15,000	20,500
511	Conferences and Study Tours Overseas	17,440	30,581
512	Grade Herd Recording	71,200	71,200
513	Conferences and Study Tours Australia	10,100	17,950
514	In Service Training	5,900	16,300
515	Post Graduate Training	4,320	15,250
		\$1,078,011	\$1,104,189

A further amount of \$14,085 was provided by the Commonwealth during the year to meet salary increases. Hence, the total allocation was \$1,118,274.

The Research Laboratory at Wollongbar was completed. It was a three-year project with a total cost of \$555,657. It was officially opened by the Hon. J. D. Anthony, M.H.R., Minister for Primary Industry. Also completed in 1970–71 was the Agricultural Engineering Centre at Glenfield, a two-year project costing \$65,143.

HAWKESBURY AGRICULTURAL COLLEGE

GENERAL

Courses

There are five tertiary-level courses at the College.

Hawkesbury Diploma in Agriculture (H.D.A.). — The new course commenced in 1970 and has its second intake in 1971. The old course has its last year (third year) in session in 1971.

Hawkesbury Diploma in Food Technology (H.D.F.T.). — The new three-year course commenced in 1971. The old two-year course has its last year (second year) in session in 1971.

Hawkesbury Diploma in Dairy Technology (H.D.D.T.). — The new three-year course commenced in 1971. The old two-year course has its last year (second year) in session in 1971. The first year curriculum for the H.D.F.T. and H.D.D.T. is a common course, with a few minor exceptions.

Hawkesbury Diploma in Poultry Technology (H.D.P.T.). — The new two-year course commenced in 1970, and had its second intake in 1971.

Hawkesbury Diploma in Rural Extension (H.D.R.E.). — This new one-year post-graduate course commenced in 1970. The second course is in session in 1971.

Staff

The Public Service Board made a determination in August 1970 to re-establish the academic staff for a tertiary college. Salaries were made consistent with university salary scales, with working conditions continuing as for professional staff of the N.S.W. Public Service. Further variations, sought to make conditions for academic staff more like those for staff of independent Colleges of Advanced Education, are as yet not wholly resolved.

The new academic establishment consists of: five senior lecturers, in charge of courses; four senior lecturers, in charge of disciplines; nineteen lecturers; and five assistant lecturers.

Public Service Board and Treasury approval were given for nine new technical support staff positions.

Negotiations concerning the status and responsibilities of other professional staff on the establishment were not completed.

Delays in filling academic and support staff positions, and two key professional positions, caused problems in programming the new diploma courses.

The Public Service Board began a close inspection of the clerical and administrative staff to achieve greater efficiency as a College of Advanced Education.

A system of committees was established to facilitate the organization and communication of College operations. A College (staff and student) Council acts as an advisory body to the Principal, mainly on matters of common interest to staff and students. The Committee of Management deals with questions of policy and development of staff and material resources. The Academic Board deals with academic matters common to all courses and Schools Committees deal with matters relating to individual diploma courses. Department Committees deal with matters relating to individual disciplines. The Library Committee promotes library efficiency and use. The Farm Management Committee deals with planning for the farm and farm sections with major emphasis on their teaching functions.

Buildings and Facilities

Capital development made good progress by virtue of Commonwealth Grants for Technical Training and for Advanced Education.

The animal husbandry building was occupied. The engineering building and the tutorial building for the school of food technology neared completion. The controlled environment broiler building for the school of poultry technology was finished. Planning was well advanced for the two further major buildings of the current advanced education triennium (1970-72), the food processing plant and the administrative centre.

The telephone system was renewed throughout and a larger PABX installed. Tenders were called for a new sewerage system. Contracts are about to be signed for the renovation of Thompson Block (student accommodation) and one stage in the renovation of the dairy factory, involving new roofing and new flooring, is nearly finished. The dairy factory boiler system was connected by steam line to the main building complex to supply heating and hot water to the kitchen, laundry, dormitories and laboratories from this source. The installation of new transformers to improve the electricity supply at the main buildings is nearly completed.

Detailed advanced planning proceeded for use of Commonwealth Grants for Technical Training and Advanced Education up to 1975, was less detailed plans outlined for later years. College planning is a co-operative effort between College staff, other Department of Agriculture staff, and the Public Works Department. Planning is guided by two ideas: first, to provide excellent facilities for present courses with adequate provision for expansion; and second, to provide a nucleus from which further educational operations can be built readily. The importance of the latter aim is high-lighted by plans for the City of Sydney which envisage an increase of population of 730,000 west and north-west of Parramatta before the end of the century. Hawkesbury Agricultural College is the only College of Advanced Education in this region.

Students

A notable development was the Minister's approval of the admission of female students to all courses, and of the admission of day students to the extent of fifteen per cent of student population. Girls had been admitted to the Food Technology course in 1969 and Diploma Day, 1971, was a unique occasion, with graduation of the first two female students in the history of the College.

Status of Diplomates

The Public Service Board decreed that new diplomates will be accorded three-year university graduate status on employment. The Board made two other concessions which facilitate graduate status for some of the older diplomates. One of these, of special interest to the College, is the successful completion of the Rural Extension course.

Department of Education Traineeships

Following the decision of the Public Service Board concerning graduate status of holders of the new diploma, the Department of Education offered teacher traineeships to students in the Agriculture course for the first time. Traineeships are held by four first year and eight second year students who will require a further one year of study at a Teachers' College on completion of the Agriculture diploma course.

Public Relations

The College continued to enhance its relations with people and with many organizations.

Every Thursday (Visitors' Day) groups of people come to inspect the College. Others come by special arrangement on other days or at weekends. These visits, formal or informal, are regarded as effective forms of extension and excellent public relations.

The number of overseas agriculturists visiting the College increased again. They came from India, Pakistan, Korea, Vietnam, Germany, France, Samoa, Fiji, Japan, U.S.A., U.K., various African countries, Philippines, New Guinea, Thailand and Malaysia and included visitors who undertook training courses of some months duration.

Co-operation with Other Organizations

The College continued to co-operate with and to receive co-operation from many government, semi-government and private organizations; notably, other state government departments and authorities, the Commonwealth Department of Education and Science, the Commonwealth Department of External Affairs, the CSIRO, the Australian Atomic Energy Commission, the A.B.C., universities, banks, local government organizations, various technical societies, many companies associated with the agricultural, food, dairy and poultry industries, the Rural Youth Movement, the Agricultural Bureau, and growers' organizations.

Short-term Schools and Conferences

The following short schools and conferences were held at the College during the year (attendance in brackets): Microbiology of Meat Products School (20); Foreman in the Food Plant (60); Rabbit Inspectors' Refresher Course (25); Dairy Officers' (North Coast) Conference (12); District Agronomists' Conference (80); Pig Raisers' School (40); Rural Youth School (40); Milking Machine Efficiency School (10); Summer School of Apiculture (20); Smallgoods Manufacturing Workshop (45); Extension Service Methods School (40); Meat Quality Control School (20); Council Officers' Weeds School (25); Friesian Cattle Judging School (80); Crop Protection School, Afro-Asian Group (30); and the Division of Horticulture Conference (100).

The Annual Poultry Field Day attracted some 1,400 visitors. There were attendance of 30 at a vegetable field day and 200 at a stone fruit field day.

THE FIVE DIPLOMA COURSES

DIPLOMA IN AGRICULTURE: H.D.A.

The first year of the new Agriculture diploma course was completed satisfactorily but under difficulties because some academic and supporting staff positions were not filled and facilities with which to conduct some of the new courses were lacking.

1971 Intake.— the 1971 intake was lower than usual because of impending renovations to the Thompson residential block. The first eight girls to enter the Agriculture course were included, and one male day student.

Enrolments:— Enrolments for 1971 were: 52 in Agriculture III — old course; 57 in Agriculture II — new course; and 58 in Agriculture I — new course. The total was 167 of whom 52 were sons of farmers and graziers: 16 in Agriculture III, 21 in Agriculture II and 15 in Agriculture I. Of the 58 students admitted to Agriculture I, 57 possessed the Higher School Certificate and one possessed the equivalent.

Diplomas awarded. — Of the 49 diplomas awarded, 4 were second class honours, and 45 were pass diplomas.

Employment. — The 49 diplomates from 1970 obtained employment as follows: farming and grazing properties — 8; State Government Departments — 20; other Government agencies — 5; private firm as a technical representative — 1; companies associated with agricultural and pastoral industries — 2; teacher training — 1; national service — 2; and miscellaneous and unknown — 10.

DIPLOMA IN DAIRY TECHNOLOGY: H.D.D.T.

The new three-year diploma course began in 1971. Various sections of the industry co-operated through the Food Science Board of Studies in construction of the course which should ensure that the dairy industry continues to receive diplomates capable of coping with the complexities of modern manufacturing techniques and management. Sponsorship of students continued at a high level; 15 of the 20 new students were assisted financially by industry or by the Department.

Enrolments:— Enrolments for 1971 were: 12 in Dairy Technology II — old course; and 20 in Dairy Technology I — new course. First year students included the first female student, two students sponsored by the Zambian Dairy Produce Board, two from Tasmania and one from South Australia.

Diplomas awarded: — Of the 14 diplomas awarded, one was at first class honours, 3 at second class honours and 10 at pass level.

Employment:— The 14 diplomates from 1970 were all employed in the industry: 10 in N.S.W., 2 in Tasmania and 2 in South Australia.

DIPLOMA IN FOOD TECHNOLOGY: H.D.F.T.

The new three-year diploma course began in 1971. On the recommendation of the Food Science Board of Studies, the first year students of the Food and Dairy courses are following a common curriculum. The aim of the Food Technology course is to train production technologists for the food and dairy industries of Australia who will be competent as laboratory control personnel and in management of production technology associated with the processing and marketing of foods.

Enrolments:— A total of 35 students were enrolled: 13 in Food Technology II — old course; and 22 in Food technology I — new course. The first year students included two from South Australia.

Diplomas awarded:— Diplomas awarded were: honours (first class). —1; honours (second class).— 1; and pass 10.

Employment:— With the continuing shortage of trained food technologists all 1970 diplomates were able to obtain positions readily with private industry — 11 in N.S.W., and one in Tasmania.

DIPLOMA IN POULTRY TECHNOLOGY: H.D.P.T.

The Poultry Technology course entered its second year under considerable difficulties. The major problem has been in securing suitably qualified staff. A senior lecturer has now been appointed. His arrival should ease the present situation, and provide the opportunity to consider progress towards a three year course. The interest of the poultry industry in the course has been high but student enrolments have been low.

Enrolments: — There were 10 students enrolled: 7 in Poultry Technology II; and 3, including one girl, in Poultry Technology I.

DIPLOMA IN RURAL EXTENSION: H.D.R.E.

The Rural Extension course entered its second year after a successful first year. The course has generated considerable interest throughout the Commonwealth and beyond, with consequent pressures for admission.

The 12 members of the first session, including one from South Australia, all successfully completed their programmes of study, workshops and project work. The second session of 13 students includes one from South Australia and one from Tasmania. The eleven students from N.S.W. include 8 from the Department of Agriculture, one from the Rural Youth Service, and 2 from the Soil Conservation Service.

Enrolments. — There were 12 students enrolled in 1970 and 13 in 1971.

Diplomas awarded. — All 12 students in 1970 were awarded pass diplomas.

ASSISTED STUDENTS — ALL COURSES

Of the total of 243 undergraduate students in 1971, 155 (64 per cent) were in receipt of bursaries, scholarships, traineeships or other forms of sponsorship.

All the post-diploma students (Rural Extension) were sponsored. There were 38 Public Service Board trainees.

PRACTICAL TRAINING

Emphasis continued to be placed on the provision of practical training for students in all diploma courses.

Agriculture. — In Agriculture practical training time is the equivalent of one day per week throughout the course. First year students concentrate on the acquisition of basic skills and knowledge, the second year students are introduced to applied agricultural technology on farms and in industry, and the third year students concentrate on application of theory to practice in applied projects.

Food and Dairy Technology. — In Food and Dairy Technology all first year students work in the dairy factory and the food plant for one day per week alternating between venues. The second year students have two days per week in the dairy factory or the food plant according to the course they are undertaking.

Poultry Technology. — Poultry Technology students spend some time every day in practical training and half a day per week on district visits to the poultry industry.

Rural Extension. — The Rural Extension students have been conducting a continuing field project with a group of property owners at Portland. The project enables them to experiment with new approaches to extension.

EXTRA-CURRICULAR ACTIVITIES

Extra-curricular activities continued to be an important feature of College life. The various teams observed the high tradition of College sport. The social life and welfare of the College was assisted by the College Council, Students' Representative Council, Sports Club, Debating Society, Camera Club, Students' Christian Movement, the College Branch of the Agricultural Bureau and the Hawkesbury Collegians Service Club.

SCHOOLS, DEPARTMENTS AND SECTIONS

SCHOOL OF FOOD TECHNOLOGY

Staff Training

Staff training has been emphasised, particularly by maintaining contact with the food industry throughout Australia and beyond. The Senior Lecturer undertook a two-week study tour of New Zealand, and also visited Queensland and Victoria. Lecturers have inspected food plants in N.S.W., Queensland and Victoria. One lecturer availed himself of the opportunity to visit educational institutions and food plants in India during annual leave.

Short Schools

The 12th Winter School for Factory Foremen was held in conjunction with the Food Technology Association of N.S.W., the Smallgoods Manufacturing Workshop in conjunction with the Meat and Allied Trades Federation (N.S.W. Division), and the Meat Quality Control School in conjunction with the Australian Meat Board. The record numbers attending these courses, the pressure for admission, and the Australia-wide representation on all courses have indicated the need for them.

A further development in the training programme has been the provision of short-term specialised training for post-graduate and post-diplomate personnel in commodity orientated procedures. A United Nations Fellow from Turkey spent seven weeks on a project related to quality control procedures for fruit and vegetable processing.

Factory Production Statistics

Processing at the School of Food Technology includes more than 80 types of product. Most products are made for educational purposes only, but the following were produced for College consumption: jams 1,725 lb; canned fruit 6,255 lb; dehydrated fruit 44 lb; fruit pulp 507 lb; canned vegetables 2,883 lb; dehydrated vegetables 24 lb; pickled vegetables 1,485 lb; quick frozen vegetables 5,345 lb; and soups, sauces and cordials 492 lb.

SCHOOL OF POULTRY TECHNOLOGY

Facilities were improved by the completion of the controlled environment broiler building and the availability of office space for lecturing staff in the new animal husbandry building.

The course has gained greatly from co-operation with officers of the Poultry Branch of the Department. Another benefit has been that poultry officers have been able to re-introduce the random sample testing of broilers using the two new broiler sheds of the Poultry School.

SCHOOL OF DAIRY TECHNOLOGY

Factory Operations

Production at the dairy factory was at a lower level due to disruption while the floor was renewed. During the factory renovations the Nepean Milk Co-op. Ltd, assisted in making alternative arrangements for the market milk operation.

Tenders were called for a new ice cream freezer. The new Gouda roller drier began operating in November, 1970, enabling a substantial increase in the amount of skim powder manufactured.

Dairy Factory Statistics

Production and processing in 1970-71 was as follows (1969-70 statistics are in brackets):

butter (lb) —	88,679	(109,335);
cheese (lb), cheddar —	115,458	(135,720);
fancy —	735	(570); and
skim —	6,820	(29,824);
surplus milk from Nepean Milk Co. (lb) —	284,841	(1,026,016);
milk pasteurised for the Authority (lb) —	3,602,493	(3,597,245);
milk from other sources (lb) — H.A.C. surplus —	181,834	(281,208);
dairymen's surplus —	777,586	(283,202); and
dairymen's rejections —	55,424	(58,736);
ice cream (gals) —	1,497	(2,606);
dried milk (lb) —	133,468	(66,083);
flavoured milk (gals) —	2,524	(2,252); and
skim milk receivals (gals) —	170,685	(137,072)

Three-year Diploma Course

In the new course students undertake practical training in the dairy factory on three days in the week so extra staff are required to man the factory. Extreme delays in the appointment of this staff caused difficulty in maintaining the essential daily factory operations.

Liaison with Industry

Close contact was maintained with industry. The Senior Lecturer was invited to address the Conference of the Australian Institute of Dairy Factory Managers in Perth. He also addressed the N.S.W. Division of the Australian Society of Dairy Technology, and participated in the N.S.W. Conference of the Australian Institute of Dairy Factory Managers and Secretaries. Staff and students participated in the International Dairy Congress held in Sydney.

Staff Development

Some Dairy Officers have attended in-service training courses. The Senior Lecturer attended a one week course on the use of computers. Mr G. Fisher, Lecturer, has been awarded a grant by the Australian Dairy Produce Board to undertake an inter-state study tour of cheese mechanisation in 1972.

Industry Support

The Australian Dairy Produce Board offered scholarships to Hawkesbury Agricultural College for the first time this year.

DEPARTMENT OF ANIMAL HUSBANDRY

This department, within the School of Agriculture, was established at the beginning of 1971 with the appointment of Dr W. Pattie as Senior Lecturer in charge of the Department. The second stage of the animal husbandry building complex was completed and occupied in February, 1971. Instruction in animal sciences and some aspects of animal husbandry are carried on at this centre. Other aspects of animal husbandry are taught at the various sections.

Sheep Section

Statistics. — At June 30, the 1,440 head consisted of 250 Merino breeders, 500 cross-bred breeders, 43 Growmark breeders, 50 weaners (ewes), 737 ration and demonstration sheep and 60 rams. At shearing 30 bales (9,335 lbs) of wool were sold for \$1,436.

Pasture. — The operations of this section are concentrated, though not confined, to a newly-established area of 70 acres of irrigated pastures on either side of the main driveway. The installation of a 50 K.V.A. transformer on this site enabled the effective utilization of waste water from the dairy factory for irrigation.

Lambing. — Lambing results improved due to better condition of breeding ewes and extra care in preparation of rams for mating.

Projects. — Student and research projects included: Merino flock selection and strain investigations; Growmark breed evaluation; evaluation of mating at seven months of age; lambing difficulties in maiden ewes mated to various sires. Co-operative research included field evaluation of jetting chemicals (Biological and Chemical Research Institute) and infertility investigations (Dr D. Fowler, Division of Animal Industry).

Beef Cattle Section

Facilities. — The new beef cattle shed is proving invaluable for the conduct of a number of trials. It will meet needs for a considerable time into the future. Four herds are maintained: the stud herd, the commercial herd, the demonstration herd and the ration herd.

Statistics. — The stud herd consisted of 65 females and 23 males (including 4 sires); 11 yearling bulls were transferred or sold during the year. The commercial herd consisted of 80 breeders plus replacement heifers. Culls and steer progeny were transferred to the ration herd and 30 surplus females were transferred to Grafton Agricultural Research Station. There were 50 females in the demonstration herd and 90 head from the ration herd were slaughtered for rations during the year. The total number of cattle in all herds at June 30 was 422 head.

Demonstrations. — Student instruction has included the following long-term demonstrations and trials: breeding herd management; steer production; comparison of hemi- and fully-castrated animals for production efficiency and carcase merit; performance recording, culling and selection of heifers and of beef sires; breed influences on cross-breeding practices and controlled crossbreeding systems.

Research. — Co-operative research projects include supplementation trials with urea and biuret (Dow Chemicals) and synchronised oestrus and A.I. trials involving the breeding of the entire demonstration herd by this technique (Graham Park A.I. Centre). Close co-operation has been maintained with Professor Butterfield of the School of Veterinary Science, University of Sydney.

Piggery Section

Statistics. — The stock on hand at June 30, totalled 208. The permanent breeding stock were: Tamworth — 1 boar, 2 sows; Berkshire — 2 boars, 7 sows; Landrace — 5 boars, 19 sows; and Large White — 5 boars, 27 sows.

The demand for stud pigs could not be met in full; 22 were sold for \$1,248. From 61 litters, 566 pigs were born for a whole herd average of 9.3 pigs per litter.

Projects. — Student's projects included : protein feeding with different levels of lysine; growth promoters; maize/wheat meal rations; continuous performance testing on the brood herd; controlled breeding.

Dairy Cattle Section

Statistics. — At June 30 the stud herd consisted of 157 cattle including 6 adult bulls, 6 loan bulls, 50 cows in milk, 10 dry cows, 37 heifers, and 48 calves under 12 months of age. During 1970–71 there were 60 births (26 females and 34 males) and 23 sales returning \$6,450. Transfers consisted of 6 males and 8 females to Wollongbar for research.

Extensive use is still being made of Canadian-bred bulls and their progeny.

Staff. — Since the resignation of Mr N. Hawke at the end of 1970 visiting staff from the Division of Dairying have provided instruction for students.

Trials. — Trials included testing of samples from the College, Wagga and Yanco for protein and testing of the College herd for solids-not-fat. A trial on the polyunsaturated fat content of milk is being prepared.

Apiary Section

Statistics. — There were 150 productive hives and 40 nucleus colonies. A total of 9,000 lb of honey was extracted.

A record number of 1,080 queen bees was supplied to meet the increased demand for College-bred stock.

Flora. — An "on" year for local flora saw flowering of red gum, grey iron bark, bloodwood and grey gum. This provided surplus honey, making it unnecessary to migrate the honey producing hives until the end of December, when they were moved to Tarana.

Trials. — During October, the Department's apiary from Tamworth was moved to the River Farm, and is now incorporated in the College apiaries. Bees from this apiary were used to establish 45 new colonies for a trial to evaluate three strains of bees. One of them, the Russian Caucasian, is showing promise of becoming more widely used in commercial honey production.

Training. — An apiary officer-in-training was stationed at the College for twelve months. A student from Tonga under the South Pacific Assistance Plan, undertook a six-months comprehensive course to fit him for the task of establishing a beekeeping industry in Tonga.

The Annual Summer School in Apiculture was held in January, and demonstrations were given at the Amateur Beekeepers' Association Field Day at the College in February.

DEPARTMENT OF PLANT SCIENCES

This Department was formed within the School of Agriculture at the beginning of 1971 with the appointment of Dr F. McMullen as Senior Lecturer in charge. The staff was strengthened by the appointment of Dr F. Kelkeher later in the year. Lack of facilities has hindered, and will continue to hinder, the work of this Department until the laboratories and field facilities planned for the 1973–75 triennium are completed.

Obituary

With deep regret, the death is recorded of Farm Manager, Mr J. Arthur, on 22nd February, 1971.

Orchard Section

Season. The year was generally most suitable for orchard operations. The good, well-distributed rainfall of spring and summer led to excellent growth and cropping of deciduous fruits. A long series of frosts during the dry winter culminated in an all-time record of 19°F on July 14 which caused moderate to severe damage to many citrus trees and fruits.

Production. — Fruit production for the year was approximately 1,500 bushel cases from 14 acres of orchard.

Trials and demonstrations. — Besides their value in teaching, trials and demonstrations in the orchard were of benefit to the Division of Horticulture. They included: trials with new peach and nectarine varieties; a planting of poplar selections to demonstrate the culture of this crop for timber production; small plantings of strawberry seedling selections to test their possible commercial use in this district; citrus renovation by skeleton and hedge pruning; and irrigation experiments including trickle and drag-hose systems.

Farm Section

The winter was very dry, with severe frosts including a record frost in mid-July. Rainfall in spring and summer was good and well-distributed, giving excellent growing conditions. Little supplementary feeding was required until late autumn 1971, when it again became dry.

On the farm 200 acres of improved pasture were sown during the autumn and 140 acres were sod-seeded with oats at the River Farm.

Most of the previously conserved fodder was used in the dry winter period but an excellent harvest followed allowing the conservation of 2,347 bales of pasture hay, 300 bales of oaten hay and 206 bales of Japanese millet hay. In addition: 25 tons of grass hay was stacked for beef cattle feed lot trials and 14 tons for bedding for the dairy, piggery and poultry sections; and 450 tons of haylage and 350 tons of silage were made during the year. Maize (200 bushels) and grain sorghum (140 bushels) were harvested at the River Farm for student instruction.

Two small water tanks were completed and one was commenced in the Blacktown area for the beef cattle section. Conserved water was in good supply with 18,000,000 gallons in the "turkey nest" dam and 15,000,000 gallons in the "hillside" dam.

In the horse section 11 Arab foals were born, 7 colts and 4 fillies. In a very successful reducing sale in April 1970, 16 assorted females were sold for a total of \$32,800, an average of \$2,050. The top price was \$2,800 for a grey three-year-old filly, Pukwana (Wagga). Horses were sold to Western Australia, South Australia, Victoria, Queensland and N.S.W.

WAGGA AGRICULTURAL COLLEGE

THE DIPLOMA COURSE

Enrolment

The College commenced its twenty-second academic year (1970) with a total enrolment of 134 students. Eleven students withdrew during the year so that 123 students attempted final examinations. Enrolments in the five years to 1971 have been.

	1967	1968	1969	1970	1971
First Year	63	47	53	57	56
Second Year	45	45	37	47	46
Third Year	26	43	43	30	44
Total	134	135	133	134	146

Diploma Examination 1970

Of the 30 students who attempted the 1970 final diploma examinations, 29 succeeded in satisfying all requirements and deferred examination was granted to one student, who was successful. Two students achieved Honours Class II standard. The total number of diploma holders since 1951 is now 509 including 39 Honours diplomates.

Second and First Year Final Examinations 1970

Second year. — All 47 students enrolled attempted the examination at the end of the year — 44 were successful, 3 failed and were granted deferred examinations. Of these 3, none was successful.

First year. — Of the 57 students enrolled, 11 withdrew during the year and 46 presented themselves for final examinations — 35 passed and 11 sat for deferred examinations in first term 1971, 4 being successful.

1971 Enrolments

Of the 56 new students enrolled, one withdrew voluntarily and one died. The second year enrolment was 46 students, of whom 39 passed first term examinations, 2 withdrew from the course and 5 failed the examinations. The third year enrolment was 44 students. It is anticipated that the number of students for 1972 will be approximately 162.

Ex-students

The total number of ex-students from March, 1949, when the College began, is 758 made up of: W.D.A. — 509 including 39 Honours diplomates; H.D.A. — 8 including 3 Honours diplomates; H.D.A. (Hort.) — 4 including one Honours Diplomate; and 237 non-diplomates.

Academic Staff

Some restructuring followed a decision to grant the academic staff of this College the salaries that apply to Colleges of Advanced Education generally. The Public Service Board determined that the positions of Deputy Principal and Chief Lecturer were to be deleted and, in lieu, a number of senior lectureships were to be created with one of the senior lecturers receiving an allowance to act as second-in-charge of the College. Subsequently, creation of the position of Secretary was approved with a salary grade of 7/8. The position has not yet been filled. The initial establishment of senior lectureships was three; two have been appointed so far.

All members of the academic staff were retained after the re-structuring. A number were re-classified.

The College acknowledges its indebtedness to the Wagga Wagga Technical College for instruction in woolclassing and in trade subjects; to Wagga Wagga High School for instruction in English expression, communication theory and practice and biomathematics; and to the Department of Main Roads for instruction in geology. Lecturing assistance in agronomy was given by staff of the Agricultural Research Institute.

Academic appointments. — Dr R. R. Storrier and Dr R. J. Banyer were appointed to new positions of Senior Lecturer.

Curriculum

The 1970 second year and the current third year have followed the same curriculum as was previous years. 1971 is the last year of the old curriculum.

The four x 10-week-term was introduced at the beginning of 1971 and the second year students commenced stage 4 of the programme. The new 1971 intake came into residence at the end of summer term for orientation and commenced study at the beginning of autumn term.

Extra-Curricular Activities of Students

Sports were the major extra-curricular activity. The new curriculum and the introduction of the four term year caused difficulties in organising some sporting fixtures. As a result, the College has regretfully withdrawn from the Australian Agricultural Colleges Intercollegiate Sports Association. 1970 was the last year of our participation.

In sport: three football teams were entered in the Riverina Rugby Football Competition; both rifle and tennis teams contested these sports at the Intercollegiate contest at Roseworthy Agricultural College in August, 1970; teams were entered in the Wagga District Amateur Basketball Competition and the Wagga District Tennis Association Competition; the College cricket team played the annual match against Hawkesbury Agricultural College; and intra-College contests were held in billiards, rugby, swimming and athletics.

In other activities; debating and public speaking competitions were held both within and outside the College; the Student Christian Movement functioned particularly well; the Photographic and Music Clubs continued to provide some enjoyment for those interested; and the Student Social Services Committee were responsible for some worthwhile community service work.

Practical Training

The College, as always, is indebted to farmers in all districts, for their co-operation. They have provided invaluable assistance in whole farm studies in farm management and in general farming practices to students during vacations and on student tours.

The third year students gained valuable experience in animal husbandry and in stockhandling whilst acting as stock attendants at both the Wagga Show and the Royal Easter Show.

The new curriculum provides for each student to carry out 30 weeks of practical training on the College, on private properties and in industry. This time is allocated as 10 weeks on campus in stage III of the programme, 10 weeks in stage VII and 10 weeks in stage X of the programme. The latter two periods are to be off-campus except that students may work on a particular project at the College for some of their stage X practical training.

Tours

Third year students made the annual five-day tour of the central slopes, southern tablelands and south coast in October 1970. This tour has always proved to be most beneficial in broadening the scope of education in farm management practices for senior students.

Half and one-day visits were made to local and district properties, to field days and to research stations for farm management surveys and valuation exercises and to keep up with developments in agricultural research.

SHORT-TERM SCHOOLS AND CONFERENCES

The short-term schools and conferences held at the College were: the 19th Annual Rural Youth School in August, 1970, on the theme of beef cattle husbandry — attendance 29; a Machinery Maintenance School for farmers conducted by the Agricultural Machinery Officer of the Southern Region of the Department in August, 1970; a School in Farm Management and Economics in August, 1970 conducted by the Division of Marketing and Economics — attendance 46 N.S.W. and interstate property owners; a Rural Safety Course on farm tractor operation in September, 1970, conducted by officers of the Safety Section, Department of Labour and Industry; a seminar on coarse grain production in March, 1971, organised by the Southern Region of the Department; the Rotary International District 270 Rotary Youth Leadership Award Seminar in March, 1971 — attendance 91; and an in-service school in farm management organised by the Division of Marketing and Economics — attendance 30.

NEW BUILDINGS AND OTHER DEVELOPMENTS

Another stage in the building programme was finished with the handing over of the Science Block complex at the start of 1971 and the completion of the Dining Room-Kitchen complex. A new cottage was completed and occupied and a machinery shed erected in the farm section.

A ring road was completed. It will enable closing of the road dissecting the campus, eventually creating a traffic-free campus area. Further progress was made with major electrical reticulation work; an extension on the western boundary of the College will service the dairy which is near completion, the irrigation section and an existing cottage.

Riverina College of Advanced Education

Arrangements were made for the developing Riverina College of Advanced Education to take over from the College an area which may be as much as 200 acres. The area is on the southern boundary of the College. While the transfer will reduce the land available to the College it will not seriously inconvenience activities provided sensible boundaries are negotiated.

Lease of Additional Land

Arrangements were made to lease an area of 540 acres adjacent to the north-western boundary of the College with an option to buy.

FARM, IRRIGATION, ORCHARD AND LIVESTOCK SECTIONS

Farm Section

The season was generally favourable for grain production but excessive rain during the hay harvest reduced yields and quality. Cereal grain yields were: wheat — 6,568 bushels from 158 acres, an average of 41.5 bushels per acre; oats — 3,150 bushels from 62 acres, an average of 50.8 bushels per acre; and barley — 2,333 bushels from 55 acres, an average yield of 42.4 bushels per acre.

Consignments of feed and seed grain transferred amounted to 2,500 bushels. Fodder conserved was made up to 200 tons of pasture hay, 150 tons of lucerne hay, 90 tons of cereal hay and 100 tons of haylage.

Improvements. — A new machinery shed was built to store the increasing number of farm machines. Over one mile of sub-division fencing was replaced and 60 chains of old boundary fencing was replaced with rabbit-proof fencing.

Farm Equipment. — Major items of equipment purchased were a front-end loader and a conveyor-elevator.

Vehicles. — Two mini-moke vehicles and an eleven passenger bus were added to the vehicle fleet, and the old tipping truck was replaced by an eight-ton tipping truck.

Irrigation Section

A large scale re-development programme began. 34 large trees were removed and extensive filling and regrading enabled more efficient watering. Some 3,000 ft of 6 inch low-head asbestos pipe with hydrant risers were installed to permit the filling in of about 2,000 feet of open channel and for re-cycling water. An additional ring tank of about two acre feet capacity was excavated so that drainage water could be held for re-use.

Maize for grain yielded 140 bushels per acre. Sorghum for grain yielded 110 bushels per acre. Two silos of 300 bushels capacity and grain drying equipment were installed. A 60' x 30' prefabricated steel shed was built for hydrological demonstrations.

Orchard Section

A vine hoe was put into use in the orchard. It is of value in tree plantings as well as the vines because the orchard is contoured.

Plans to develop the irrigation were delayed pending assessment of college water resources. However, the new citrus planting was trickle irrigated. The system appears to have definite advantages in maintaining young trees. Trickle irrigation was also supplied to one row of pears but was not needed because rainfall was adequate.

Benches were built in the new demonstration room and sinks are ready for installation. They will facilitate the use of the room by students for various testing techniques mainly related to fruit maturity.

Livestock Sections

Animal Health. — All dairy cattle were in good health, reflecting an excellent season. As usual, a few cows required treatment for milk fever. Three day sickness was diagnosed in four cows, one immediately prior to transport to the Royal Easter Show. Three cows were culled for infertility, and one following an acute mastitis attack. Strain 19 vaccination was carried out on all heifers between 3 and 6 months of age.

The season was generally good for the beef cattle and the cows were in excellent condition throughout the year. Death at birth of 12 of 38 Murray Grey calves out of Angus cows was attributed in part to oestrogenic clovers apparently causing uterine atony. Average birth weight of the calves was 58 lb. Premature separation of the placenta was also observed in a few cases.

A poll shorthorn bull, Gundibri General 27th, introduced to the College in 1970 failed to get any cows in calf and a semen test conducted in March 1971 suggested testicular degeneration.

The Murray Grey bull, Kevin Grove Adonis, on loan to the College in 1971 had the necessary negative tests to disease. One yearling bull was destroyed after showing generalised arthritis, and a further yearling bull was destroyed after failing to respond to surgery for removal of a urethral calculus.

Strain 19 vaccination was carried out on the heifer calves.

One Arab foal died from shigellosis, and Arab colt, Cypher Crown A 222, was destroyed following severe leg injury when he became entangled in a wire fence.

Footrot was diagnosed in a mob of 500 Merino ewes in the spring. Thorough and rigorous treatment has apparently completely cured the flock but they will be kept in isolation until after the coming spring. Heavy worm burdens were detected in the weaner sheep in December. Laryngeal abscess was diagnosed in two Dorset rams which died despite antibiotic therapy.

Horse Section

Numbers. — At May 31, 1971, numbers in the horse section (change from the previous year in brackets): entires 4 (-1); mares 41 (+ 8); geldings 7 (+ 1); and foals 10 (- 5). The total was 62.

Transfers. — Five geldings were transferred to Trangie Agricultural Research Station. The Arab stallion "Sala" (imp) was transported to the University of Sydney where he was destroyed and his skeleton retained as an example of the Arab horse.

Services of privately-owned mares. — During the 1970 breeding season 18 original and 5 free return services were given, returning \$1,400 for services and \$465 for agistment.

Shows. — At the 1971 Royal Easter Show exhibits from the Arab Horse stud gained the award for reserve champion Arab mare, three second prizes and one third prize.

Beef Cattle Section

Numbers. — At May 31, 1971, the 163 beef cattle were made up of (change from the previous year in brackets): stud males 9 (- 11); stud females 56 (- 15); grade males 15 (+ 3); and grade females 83 (+ 7).

Sales. — Nine stud Poll Shorthorn bulls were sold for the average price of \$450 and 18 steers and 26 females were sold.

General. — The Poll Shorthorn bull, Gundibri General 27th, was purchased for \$2,000 and three Poll Shorthorn females were transferred to Hawkesbury Agricultural College. Mr M. Gadd of Wodonga donated two Murray Grey steers to the College. One subsequently gained first prize in the class for Murray Grey steer carcasses at the Sydney Royal Show. One Murray Grey sire was received on loan for a short period to facilitate the continuation of the Murray Grey grading-up programme.

Sheep Section

At May 31, 1971, the College had 2,346 sheep, 394 more than a year before. 1970-71 was a year of consolidation. Shortage of manpower led to re-examination of the activities of the section and a revised programme. Further development will depend upon the requirements of the new curriculum. Facilities were improved by the provision of a building for demonstrations and the replacement of the floor of the shearing shed.

Dairy Section

Numbers. — At June 30, 1971, there were 137 cattle in the herd: 120 Jerseys (- 14 on the previous year); 4 Aryshires (+ 1); 9 Fresians (+ 3); 2 Guernseys (+ 1); and 2 A.I.S. (+ 1).

Production. — Production was maintained at a reasonably high level mainly due to favourable conditions with unusual summer rains. During the summer, continuous grazing was not available and forage harvested lucerne from the irrigation section provided a large part of the feed. Feed resulting from the summer rains allowed supplementary feeding during autumn 1971 to be kept to a minimum.

Unofficial production figures show that 41 cows completed tests for an average of 7,934 lb milk at 4.9 per cent test and 394 lb butter fat. These figures do not include the demonstration herd. The lower number of cows completing test was due to the large number of cows in milk transferred to Bega Demonstration Farm.

Sale of stock. — Sales were: 5 stud bulls for \$875; cull cattle (37 head including 32 bobbie calves) for \$584; and two cows from the commercial herd for \$200. In addition, 23 cows and one bull were transferred to Bega Demonstration Farm.

Sale of milk and cream. — Sales were: Dairy Authority Sales (195,000 lb) — \$9,846; surplus milk sales (Murrumbidgee Dairy Co.) — \$2,076; and butterfat (7,317 lb) — \$2,863.

New Buildings. — Work on the new dairy buildings is nearly completed. The dairy, feed stalls and office-demonstration-amenities building are expected to be completed within a month. The move from the old dairy to the new awaits completion of roads and water supply expected in the early spring.

Herd Improvements. — The first of the daughters of the bulls "Bemersyde Dream Jester" and "Wagga Rose Liberator 3rd" came into production but it is still too early to judge the worth of these bulls. The imported sire, "The Mounts Orange Boy", continued to be used through A.I. "Froncliff Ensign" was used for limited matings. The type of animal in the herd has improved and many of the cows on their first calf could develop into excellent type as well as production animals.

Show Exhibits. — The College entered a large team at the Wagga Show and a small team at the Royal Easter Show. The results were pleasing at both. Against strong competition at Royal Easter Show the team of seven females won two second ribbons and two fourth place ribbons.

Pig Section

Numbers. — The 64 pigs on hand at July 1, 1970, were added to by 64 births. Disposals were: killed for food — 14; sold at market — 82; stolen — 4; stillborn, died and destroyed — 28.

Piggery closed. — The introduction of the new curriculum required some rationalisation between Hawkesbury Agricultural College and this College. As the piggery at this College was obsolete it was decided that it should be closed and that pig husbandry would be offered at Hawkesbury Agricultural College only. A later review will determine whether a modern piggery will be built at Hawkesbury Agricultural College or Wagga Agricultural College or both. Proceeds from sales of pigs amounted to \$1,448.08.

Poultry Section

In view of the facilities being developed at Hawkesbury Agricultural College and the specialised nature of modern poultry husbandry, a course in this discipline is no longer included in the curriculum of this College. As a result the functions of the section have changed.

The section has been developed as an extension aid and is being run as a commercial operation to produce eggs and meat chickens for the College. Turkey production has ceased. Some experiments on husbandry practices are being continued. The section retains the potential for project work for, and by, students in basic courses such as animal nutrition.

Apiary Section

A further result of rationalisation between Hawkesbury Agricultural College and Wagga Agricultural College was the decision that apiculture will no longer be included in the curriculum of this College. As a result the Apiary was disbanded.

YANCO AGRICULTURAL COLLEGE AND RESEARCH STATION

RESEARCH

Research at Yanco Agricultural College and Research Station is summarised elsewhere in this report by the Divisions of Plant Industry, Animal Industry and Dairying and the Institute of Biological and Chemical Research.

AGRICULTURAL EDUCATION AND TRAINING**FARM CERTIFICATE COURSE***Numbers of Students, and Examinations, 1970.*

Of 94 students enrolled at the beginning of 1970, 88 completed the course. The final examination was completed successfully by 62 students of whom 5 had deferred examinations. The pass rate of 70.5 per cent was lower than in 1969. The reasons for failure were lack of maturity and lack of agricultural experience.

Kelvin Baxter of Berrigan was dux of the course and winner of the Pearson Memorial Medal. He gained three High Distinctions and one Distinction level.

Despite the lower pass rate, 1970 was a satisfactory and rewarding year. The interest, co-operation and standard of work of students were all good. Leadership given by the Students' Representative Council was excellent, and contributed largely to the success of the year. Most of the students who failed still obtained great benefit from the year, both in an agricultural and a general educational sense.

1971 Enrolments

Enrolments in 1971 followed the general trend experienced by all other agricultural educational institutions and appeared to reflect the problems being experienced by the rural community. Numbers are well below those of previous years. The total enrolment was 52.

Enquiries for the 1972 course received by June, 1971, were well in advance of those at this stage last year.

IRRIGATION CERTIFICATE COURSE

An Irrigation Certificate course was commenced in 1971. The 13 students enrolled included 6 who had completed the Farm Certificate, 3 Horticulture trainees of the Department and 4 agronomists-in-training. The Horticulture trainees and the agronomists-in-training combine participation in the course with other training activities.

Although some early difficulties were encountered, the course is now functioning well. The including of the Department's trainees is of great value, giving the course greater depth and scope. In return these students should get an excellent grounding in all forms of irrigation, and a good understanding of the problems involved.

The educational approach in this Irrigation Certificate Course is vastly different from that in the Farm Certificate Course. There is less formal teaching and much more time is devoted to group activity and discussion. Much greater use is made of assignments, and the student is responsible for his own level of work to a much larger degree. These methods can be used much more effectively because of the students being more mature and the number is small.

Early problems encountered in the course are being overcome. The position of Lecturer in Basic Sciences was filled in late June, 1971. Some new publications and an intensive effort to build up the library's holdings have alleviated the early lack of satisfactory text books and reference material. Preliminary plans are in hand for a new Irrigation Teaching Unit which should solve the problem of shortage of equipment and laboratory facilities.

The death of Mr J. I. Thomson, M.I.Agr.E., Lecturer in Irrigation Engineering, was a severe loss to the College. In his short time in the position, Mr Thomson did much to organise the Irrigation Certificate Course and establish it soundly.

The Irrigation Certificate Course will be severely affected until a Lecturer in Irrigation Engineering is appointed.

With the introduction of the Irrigation Certificate Course, the lecture programmes of all staff were re-arranged. In most cases this resulted in an increased lecture load.

BUILDING PROGRAMME

A new shearing shed and yards were completed as the first stage in the development of the new animal husbandry teaching complex. Plans are in hand for a livestock demonstration area and a workman's cottage. Piggery and poultry units and additions to the beef cattle yards will eventually complete this area. The old shearing shed which was close to student dormitories will be demolished.

The College swimming pool was completed and a filtration plant and lighting were added.

Building plans in hand include a new library to cater for both education and research needs, the second stage of the animal husbandry complex and the irrigation teaching laboratory.

EX-STUDENTS' ACTIVITIES

The Old Boys' Union remained very active and established four special annual prizes for improved students. Three students graduated from universities and one from Hawkesbury Agricultural College. A number of other ex-students are completing tertiary education, whilst more recent ones are completing matriculation requirements in order to undertake university courses.

APPENDIX I

ACCOUNTS OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1970/71.

The cost of maintaining the Department of Agriculture is met from the Consolidated Revenue Fund, whilst capital expenditure on buildings and permanent improvements to departmentally owned property is a charge on the General Loan Account.

In addition to the foregoing sources of funds, the Department is assisted in financing certain specified lines of research and development, together with the control of insect pests and animal diseases, by levies on industry and by grants from the Commonwealth, semi-Governmental and public and private organizations. Operations in this category are reflected in a large number of accounts within the classification of "Special Deposits" accounts, details of which are given later in the Appendix.

COMPARATIVE STATEMENT OF EXPENDITURE.

Account	1969/70	1970/71	Increase or Decrease
	\$	\$	\$
Consolidated Revenue Fund	17,612,441	20,244,176	2,631,735 (increase)
General Loan Account	1,520,000	1,377,997	142,003 (decrease)
Special Deposits Account	11,903,470	13,710,933	1,807,463 (increase)
	31,035,911	35,333,106	4,297,195

EXPENDITURE FROM CONSOLIDATED REVENUE FUND

Following are details of expenditure from Consolidated Revenue Fund for the previous two years:

Division	1969/70	1970/71	Increase or Decrease
	\$	\$	\$
Central Administration	3,675,834	3,664,370	11,464 (Dec.)
Biological and Chemical Research Institute	711,787	897,500	185,713 (Inc.)
Plant Industry	946,564	1,107,870	161,306 (Inc.)
Horticulture	871,790	1,104,969	233,179 (Inc.)
Dairying (a)	1,445,770	1,490,392	44,622 (Inc.)
Research Stations (c)	1,965,311	1,667,573	297,738 (Dec.)
Agricultural Colleges (d)	1,295,452	2,427,513	1,132,061 (Inc.)
Animal Industry —			
Head and District Offices (b)	3,129,915	3,676,767	546,852 (Inc.)
Queensland Border	331,912	356,548	24,636 (Inc.)
Tick Quarantine Areas	2,601,751	3,112,549	510,798 (Inc.)
Royal Botanic Gardens	636,355	738,125	101,770 (Inc.)
	17,612,441	20,244,176	2,631,735 (Inc.)

- | | | | |
|-----|---|----------------------|----------------------|
| (a) | Includes assistance to North Coast Dairying Industry | 1969/70
\$600,000 | 1970/71
\$500,000 |
| (b) | Includes State's contribution to Bovine Tuberculosis and Brucellosis Eradication Campaign | \$378,727 | \$550,000 |

- (c) Yanco Agricultural College and Research Station included under new Division of "Agricultural Colleges" from 1st July, 1970 – previously included under "Research Stations"
- (d) New Division of "Agricultural Colleges" was commenced from 1st July, 1970, to cover Hawkesbury, Wagga, Yanco and Orange Agricultural Colleges. Hawkesbury and Wagga were previously shown as separate Divisions and the combined expenditure of these two Colleges was \$1,295,452 during 1969/70.

The amounts provided for Assistance to the North Coast Dairying Industry and the Bovine Tuberculosis and Brucellosis Eradication Campaign were transferred to Special Deposits Accounts, details of which are given later in this Appendix.

EXPENDITURE FROM GENERAL LOAN ACCOUNT

Expenditure from General Loan Account for the year ended 30th June, 1971, amounted to \$1,377,497.

Details of the expenditure are as follows:

Advanced Education —	\$
Capital Works financed from State and Commonwealth	
Allocations — State's contribution	737,500
Biological and Chemical Research Institute —	
Cotton Testing Laboratory	11,000
Rabbit House	7,000
Condobolin Agricultural Research Station —	
Cottage	2,480
Laboratory and Administration Building	322,569
Dareton Horticultural Research Station —	
Cottage	90
Glenfield Veterinary Research Station —	
Virus Laboratory	6,244
Griffith Viticultural Research Station —	
Winery	10,000
Orange Agricultural Research Station —	
Cottage	2,625
Queensland Border —	
Cottage at Barrington	6,380
Royal Botanic Gardens —	
Exhibition Glasshouse	122
Seven Hills Poultry Research Station —	
Laboratory and Administration Building	206,736
Tamworth Agricultural Research Station —	
Water Supply	862
Temora Agricultural Research Station —	
Shearing Shed	9,383
Trangie Agricultural Research Station —	
Foreman's Office and Store	9,814
Irrigation Development	19,931
Wollongbar Agricultural Research Station —	
Equipment for Research Laboratory	9,804
Dairy Building	14,957
	1,377,497

OTHER ACCOUNTS

Special Deposits Account

Following is a complete list of accounts and funds within the Special Deposits Account at the Treasury on which this Department operates:

Name of Account	Balance as at 1st July, 1970	Receipts 1970/71	Payments 1970/71	Balance as at 30th June, 1971
	\$ Cr.	\$	\$	\$ Cr.
Advances to Officers for purchase of motor cars .	Dr. 231,363.95	126,942.04	146,241.27	Dr 250,663.18
Potato Growers' Licensing Act, 1940	853.77	4,506.00	4,225.00	1,134.77
Commonwealth/State Flood Relief Scheme, 1964 .	50,035.34	—	—	50,035.34
Balance of Salaries Adjustment Suspense Account .	412,760.64	565,681.89	412,997.54	565,444.99
Commonwealth/State Flood Relief Scheme, 1971				
— Relief of Personal Hardship and Distress . . .	—	500,000.00	412,352.26	87,647.74
Commonwealth/State Bush Fire Relief Scheme, 1968	78,624.94	—	2,600.00	76,024.94
Bega Demonstration Farm — Working Account . .	382.95	22,323.25	16,823.69	5,882.51
Government Printing Office — Working Account,				
Stores Account and Sale of Publications	—	4,447.19	301.44	4,145.75
North Coast Dairy Feed Year Assistance Scheme .	103,904.37	500,363.64	485,499.98	118,768.03
Noxious Insects Destruction Account	529,099.49	280,312.75	78,673.05	730,739.19
Swine Compensation Fund	768,448.08	106,929.44	14,034.11	861,343.41
Treasury Fire Risks — Cottage — Bonshaw				
Crossing, Queensland Border	Dr. 17,665.00	—	—	Dr. 17,665.00
Treasury Fire Risks — Cottage — Tabbimoble . .	—	156.77	931.74	Dr. 774.97
Treasury Fire Risk — Division of Research				
Stations, Tamworth	—	—	23,248.78	Dr. 23,248.78
Treasury Fire Risk — Replacement of Cottage —				
Maryland Gate	—	—	11,000.00	Dr. 11,000.00
Hawkesbury Agricultural College — Canning				
Factory Account	3,241.28	2,048.31	1,330.12	3,959.47
Hawkesbury Agricultural College — Dairy Factory				
Working Account	74,836.36	376,229.14	392,233.07	58,832.43
Bush Fire and Flood Relief Account (State)	19,155.89	—	2,679.60	16,476.29
Pasture Control Account	310.88	68,897.41	49,208.29	20,000.00
Commonwealth Government Grant for Acquisition				
of Library Materials in terms of the States'				
Grants (Advanced Education) Act, 1967	1,222.84	1,565.00	1,341.97	1,445.87
Daily Telegraph TCN 9 Bush Fire Relief Fund . .	13,450.97	—	250.00	13,200.97
Unclaimed Moneys Account	2,470.72	4,307.99	1,709.78	5,068.93
Cattle Compensation Fund	1,957,804.90	501,217.28	451,531.48	2,007,490.70
V.P. Bragg Scholarship — Wagga Agricultural College	—	615.00	507.23	107.77
Wagga Agricultural College — Swimming Pool Account	1,938.30	441.00	—	2,379.30
V.P. Bragg Scholarship Account (Investment)	12,000.00	—	—	12,000.00
Wheat Industry Stabilization Fund (Disposal) for				
Research and Extension in the Wheat Industry				
— Investment	30,000.00	—	—	30,000.00
Wheat Industry Stabilization Fund (Disposal) for				
Research and Extension in the Wheat Industry				
Advanced Education — Capital Works Financed from				
State and Commonwealth Allocations Account . .	64,033.00	1,127,497.49	577,026.54	614,503.95
Commonwealth Grant — State Secondary School				
and Technical Training Projects financed under				
States' Grants (Technical Training) Act	Dr. 35,206.31	516,171.93	393,512.52	87,453.10
Australian Inoculants Research and Control Service				
— Working Account	—	65,464.76	41,502.70	23,962.06
C.B. Alexander Agricultural College - Working Account	56,829.77	271,225.26	294,954.18	33,100.85
Tobacco Industry Trust Account	11,612.91	62,248.66	71,016.92	2,844.65
Advances to be Recovered Account —				
Bega Dairy Demonstration Farm — Repayable				
Advance for Working Capital credited to				
Special Deposits Account — 63	—	—	15,000.00	Dr. 15,000.00
Purchase of Stock for the Control of Pastures at				
Condobolin Research Station	12,000.00	12,000.00	—	—
Triennial Election of five Representatives to the				
Egg Marketing Board for the State of New				
South Wales, 1970	—	—	1,538.78	Dr. 1,538.78
Poll on the Question of the Constitution of a				
Barley Marketing Board for the State of New				
South Wales, 1971	—	—	25.99	Dr. 25.99
Poll on the Question of Dissolution of Central				
Coast (N.S.W.) Citrus Marketing Board	—	—	100.17	Dr. 100.17
Triennial Election of Five Producers'				
Representatives to the Central Coast				
(N.S.W.) Citrus Marketing Board, 1970	—	—	147.38	Dr. 147.38
Triennial Election of Producers' Representatives to				
Citrus Fruits (excluding lemons) Marketing				
Board of the Wentworth Shire and that				
portion of the Balranald Shire within the				
County of Taila	Dr. = 60.90	—	5.51	Dr. 66.41
Triennial Election of Five Producers'				
Representatives to the Rice Marketing Board				
of N.S.W.	—	—	551.13	Dr. 551.13
Tuberculosis and Brucellosis Eradication Campaign .	—	1,011,106.67	1,010,830.99	275.68
Commonwealth Extension Services Grant	167,485.21	1,121,664.54	1,144,223.45	144,926.30

Special Deposits Accounts—continued

Name of Account	Balance as at 1st July, 1970	Receipts 1970/71	Payments 1970/71	Balance as at 30th June, 1971
	\$ Cr.	\$	\$	\$ Cr.
Advance for destruction of banana plants on property of R. Proctor, Bowraville	1,000.00			1,000.00
Apple and Pear Spray Residue Committee — Employment of Fruit Inspector	16.63		—	16.63
Advance for Purchase of Peat Cultures for U-DALS	Dr. 7.54	7.54		—
Advance by U-DALS for Employment of casual labour at Wollongbar Agricultural Research Station	20.77	—	23.94	Dr. 3.17
Board of Tick Control Employees' proportion of contribution towards Local Government Superannuation Scheme	5,881.30	44,757.47	45,701.57	4,937.20
Commonwealth Grant — Milking Machine Components Testing Station	134.78	2,550.22	2,379.45	305.55
Contribution by Arnotts Biscuits Pty., Ltd., towards breeding of improved Wheat Varieties in irrigation areas	8,000.00	—	300.00	7,700.00
Contributions by Auscott Pty Ltd for cotton research in the Namoi Valley	1,563.69	847.75	—	2,411.44
Contribution by Australian Bean Research Group and Commonwealth for Bean Disease Research	2,300.00	4,600.00	2,234.61	4,665.39
Contribution by Australian Fertilizers, Ltd, for Pasture Management at Wollongbar Agricultural Research Station	—	939.66	—	939.66
Contribution by Australian Meat Board — Cost of Overseas Visit — P. Baumgartner		543.00	543.00	
Contribution by Australian Mushroom Growers' Association and Commonwealth for Research into Mushroom Diseases	3,497.07	8,300.00	9,053.66	2,743.41
Contribution by Commonwealth for National Workshop on Extension Programme Planning ..	—	4,000.00	998.81	3,001.19
Contribution by Jensen-Salsbery Laboratory for Dairy Detergency Research	1,201.86	3,000.00	2,770.66	1,431.20
Contribution by Jusfrute, Ltd, for Citrus Research in M.I.A.	—	2,339.75	—	2,339.75
Contribution by Rice Industry Co-ordination Committee and Commonwealth for Rice Research	30,000.00		8,357.75	21,642.25
Contribution by Murray Grey Cattle Society for Cattle Breeding	118.75	—		118.75
Contribution by States towards salary and Expenses of Patrol Officer, Grasshopper Control (Australian Plague Locust Patrol Service)	6,797.15	5,500.00	9,267.92	3,029.23
Contribution from Central Coast Agricultural Research and Extension Committee for Research into Citrus Rind Blemish	2,000.00	2,000.00	3,965.24	34.76
Contribution to Animal Insect Pest Investigations — Glenfield Veterinary Research Station	359.85	—	—	359.85
Contributions towards Development of Tamworth Experiment Station	1,350.23	—	—	1,350.23
Dairy Industry Prices Tribunal Working Account ..		5,543.00	5,046.67	496.33
Department of Agriculture — Plant Quarantine — Special Advances		47,927.00	23,058.29	24,868.71
Department of Agriculture Suspense Account	82,158.08	64,129.78	137,525.36	8,762.50
Donation by Hamlyn House Pty Ltd, for purchase of Photographic Equipment		136.00		136.00
Donation from Austral Pacific Fertilizers for purchase of Urea	—	777.96	777.96	—
Donation by Merck, Sharpe and Dohme (Aust.) Pty Ltd, for Banana Research	83.80	—		83.80
Fees — Poultry Seminar, 1970		874.00	717.30	156.70
Grant by Australian Apple and Pear Board for Co-operative Programme with C.S.I.R.O. on Pest Management in Pome Fruit Orchards	2,353.95	1,000.00	1,464.32	1,889.63
Grant by Australian Chicken Meat Research Committee — Improvement of Breeding Techniques		5,750.00	6,219.68	Dr. 469.68
Grant by Co-operative Bud Selection Society, Ltd, towards Establishment of Citrus Mother Tree Block	6.62	—	6.62	
Grant from Council of Egg Marketing Authorities of Australia — Evaluation of Supply Control Measures in the Egg Industry	39.36	167.58	201.63	5.31
Grant from Council of Egg Marketing Authorities of Australia — Development of a Pathogen Free Flock	3,000.00	7,000.00	9,997.00	3.00
Grant by Council of Egg Marketing Authorities of Australia — Pesticide Residues in Eggs	1,125.00	—	13.60	1,111.40

Special Deposits Accounts—continued

Name of Account	Balance as at 1st July, 1970	Receipts 1970/71	Payments 1970/71	Balance as at 30th June, 1970
	\$ Cr.	\$	\$	\$ Cr.
Hawkesbury Agricultural College — Egg Laying Competition Prize Fund.....	2,157.43	1,876.00	516.68	3,516.75
Herd Recording Working Account for Purchase and Re-sale of Brackets and "U" Bolts	634.97	2,855.55	2,801.02	689.50
Manning District Agricultural Research Council — Contribution for Pasture Research in the Manning District	1,211.82	2,000.00	1,096.51	2,115.31
Mid-Coast and Upper Hunter Agricultural Research Council — Contribution towards Research	—	3,900.00	—	3,900.00
Navy Bean Marketing Board — Surplus Funds	125.71	—	—	125.71
Payment by Commonwealth to Egg Marketing Board of New South Wales	—	6,386,220.10	6,312,640.10	73,580.00
Pender, W.S. Memorial Fund — Interest on Bonds	571.49	118.00	—	689.49
Reserve Bank of Australia — Grant from Rural Credits Development Fund towards Whole Farm Feed Year Studies on Red Basalt Soils ..	607.58	—	—	607.58
Reserve Bank of Australia — Grant from Rural Credits Development Fund for Dairy Farm Development on Alluvial and Chocolate Basalt Soils in Richmond Valley	1,093.62	—	—	1,093.62
Salaries Suspense Account	—	35,359.51	35,359.51	—
Rohan Jones W. — Secondment to University of New England	1,656.19	4,116.68	5,964.48	Dr. 191.61
South Coast Agricultural Research and Extension Council — Contribution towards Research	3,380.20	3,319.72	5,528.02	1,171.90
The Sulphur Institute of U.S.A. — Grant for Compilation, etc., of Results of U.P.S.E.T. Trials	1,590.70	—	—	1,590.70
Scholarship — D. J. McDonald — Douglas MacKellar Memorial Award — Rice Industry Co-ordination Committee	2,000.00	2,100.00	2,000.00	2,100.00
Tobacco Extension Grant to finance Additional Extension Work	256.56	—	—	256.56
Tropical Fruit Research Station — Donation by Banana Growers' Federation	3,812.46	—	1,571.01	2,241.45
Unclaimed Salaries and Wages	1,428.58	12,657.91	11,077.69	3,008.80
Unemployment Relief in Drought Areas, 1970	—	28,300.00	28,545.61	Dr. 245.61
C.B. Alexander Agricultural College — Trust Account	1,831.63	6,993.09	5,307.63	3,517.09
Hawkesbury Agricultural College — Trust Account	8,560.15	8,704.00	16,814.79	449.36
Wagga Agricultural College — Trust Account	2,783.34	7,973.42	7,551.04	3,205.72
Yanco Agricultural College — Trust Account	12,055.86	2,924.13	11,570.24	3,409.75
Shannon Vale Nutrition Station — Working Account	28,681.01	4,817.79	16,065.02	17,433.78
Banana Research Committee Grant for Research — Maturation Studies	—	100.00	0.20	99.80
Handling and Packaging	396.40	453.60	8.80	841.20
Market Diseases	—	100.00	—	100.00
Ripening	561.87	200.00	300.07	461.80
Pre-cooling	100.00	—	100.00	—
Staff and Travelling	2,202.54	7,492.86	9,383.35	312.05
Australian Dairy Produce Board — Grant for Research Projects —				
Dairy Detergency	51.38	5,111.74	5,265.17	Dr. 102.05
Expansion of Other Pasture and Animal Research ..	Dr. 281.63	15,964.40	14,221.07	1,461.70
Farm Management Economics in North Coast Dairying ..	1,996.19	11,336.72	10,536.93	2,795.98
Insecticide Residues in Dairy Cattle and Dairy Products ..	—	3,502.50	1,969.53	1,532.97
Mastitis Research and Control	74.07	1,506.85	676.31	904.61
Pasture Improvement	Dr. 1,000.00	4,636.60	4,636.60	Dr. 1,000.00
Pasture Species Research	1,673.04	21,026.73	23,675.78	Dr. 976.01
Problems Associated with the Manufacture and Keeping Qualities of Process Cheese	Dr. 1,186.52	10,343.42	6,171.16	2,985.74
The Relationship between Chemical Composition and Cheese Grading	1,511.82	4,155.31	4,879.16	787.97
Use of Calcium Co-precipitates in Manufactured Meats ..	—	1,650.00	1,261.80	388.20
The Influence of Seasonal Variations on the Compositional Quality of Skim Milk on the Physical and Chemical Qualities of Spray Dried Skim Milk Powder	Dr. 1,255.24	2,373.96	1,118.72	—
Visit to South-East Asian Recombining Plants	3.83	—	3.83	—
Australian Meat Research Committee —				
Beef Feed Year Pastures — North Coast	11,343.14	29,693.37	23,893.05	17,143.46
Major and Minor Element Deficiencies in Soil from Beef Areas	192.74	203.35	157.57	238.52
Fertilizer Requirements for Pasture Production on North Coast Soils	4,366.75	17,502.32	15,283.77	6,585.30
Winter Nutrition on Northern Tablelands	1,710.73	23,162.46	23,003.59	1,869.60

Special Deposits Accounts—continued

Name of Account	Balance as at 1st July, 1970	Receipts 1970/71	Payments 1970/71	Balance as at 30th June, 1970
	\$ Cr.	\$	\$	\$ Cr.
Nature and Organization of the Australian Beef Cattle Industry	2,687.30	3,934.75	6,782.69	Dr. 160.64
Beef Cattle Improvement through Breeding Method Incidence, Importance and Control of Parasites in Cattle in New South Wales	3,385.74	19,972.86	20,606.29	2,752.31
Bloat Research	630.62	13,294.10	17,840.53	Dr. 3,915.81
The Biological Study of Drought and Supplementary Feeding of Sheep	1,671.16	4,000.00	7,752.06	Dr. 2,080.90
Sheep Fertility Service	7,022.75	646.39	7,669.14	—
Regional Economics Studies of Mutton and Lamb Production	Dr. 3,864.08	29,360.26	23,250.43	2,245.75
The Evaluation of Selection and Management Practices in terms of Carcase Characteristics Selection	7,658.68	7,858.48	12,245.11	3,272.05
Facilities for Carcase Investigations	3,360.96	7,606.31	7,857.25	3,110.02
Evaluation of Pasture and Forage Species in terms of Animal Production in the North West	21,482.84	3,040.83	24,098.86	424.81
Integration of Crop and Animal Production	1,288.58	2,980.14	5,511.23	Dr. 1,242.51
Evaluation of Potential Fine Woolled Meat Sheep Costs, Benefits and Analysis into Control of Cysticercosis	2,530.00	10,004.08	14,234.13	Dr. 1,700.05
Post-Graduate Studentship — E. R. Hart	—	7,430.00	2,137.00	5,293.00
Post-Graduate Studentship — P. J. D. O'Meagher ..	—	—	542.65	Dr. 542.65
Australian Wool Board — Grant for Research — Root Nodule Bacteria	—	1,400.00	—	1,400.00
Control of Insecticidal Resistance in Sheep Blowfly Efficiency of Wool Production	—	1,400.00	—	1,400.00
Serrated Tussock Control	578.88	9,540.00	6,292.41	3,826.47
Sheep Breeding and Pasture Management — Shannon Vale	17,748.39	13,760.00	27,755.90	3,752.49
Fleece Measurement for Selection of Stud Merino Rams	334.10	800.00	338.42	795.68
Fleece Measurement for Selection of Stud Merino Rams — Fees	8,625.56	14,087.94	19,218.04	3,495.46
Comparison of Management Systems	1,476.47	22,893.11	22,153.31	2,216.27
Adaptive Pasture Research — Southern Tablelands .	590.50	2,919.11	3,509.61	—
Aerial Control of Serrated Tussock — Southern Tablelands	2,118.08	4,350.00	5,607.67	860.41
Effect of Pasture Management and time for Lambing on Wool and Lamb Production in the South West Wheat Belt of New South Wales	2,537.10	18,780.53	18,776.18	2,541.45
Farm Management Problems of Development in the Yass Valley	313.21	1,000.00	695.60	617.61
Comparison of the Lifetime Performance of Single and Twin Born Merino Ewes	2,584.77	1,119.26	897.37	2,806.66
The Productivity of Natural Annual Pastures at Trangie with and without supplementary areas of Lucerne or Natural Perennial Grasses	1,655.08	8,720.00	6,545.50	3,829.58
The Importance of the Ram in Flock Reproduction Development and use of various Biochemical Parameters in Diagnosis	327.72	1,500.00	1,632.62	195.10
Cool Wet Areas and Southern Tablelands — Pasture Research	524.69	600.00	851.27	273.42
Interactions between Species, Nutrients, Soils — Southern Tablelands	372.77	10,690.79	3,843.42	7,220.14
Pasture/Animal Production Study	245.74	800.00	452.93	592.81
Fodder Conservation — Northern Tablelands	4,010.93	5,297.68	5,381.30	3,927.31
Forage Crops — Northern Tablelands	749.69	5,810.00	6,858.22	Dr. 298.53
Post Partum Mating of Sheep	648.14	5,810.00	6,384.75	73.39
Study of Factors Influencing Nodulation of Legumes, Survival of Rhizobia in Soil and Effectiveness of Rhizobia Strains	841.79	6,590.00	6,798.92	632.87
Training of Research Agronomist via a Study of the Ecology of Annual Weeds of Pastures	850.72	6,010.00	6,800.84	59.88
Training of Research Agronomist in Forage Ecology Ecology — R. A. Woodward	14,061.17	15,280.00	24,956.14	4,385.03
Training of Research Agronomist in Forage Ecology Ecology — Cornish and Desborough	63,755.30	14,891.48	63,607.61	15,039.17
Developments of Aerial Pasture Improvement Techniques for the Northern Tablelands of New South Wales	2,315.00	2,500.00	4,416.80	398.20
Training of Research Agronomist via a Study of the Autecology of Galvanised Burr (Bassia Birchi) in North Western New South Wales ...	—	—	452.25	Dr. 452.25
Applied Economic Research in the Wool Industry — Trangie Agricultural Research Station	797.78	5,950.00	6,087.07	660.71
	1,001.34	3,699.19	4,700.53	—
	4,786.05	5,500.00	8,511.51	1,774.54
	3,115.00	3,000.00	6,579.33	Dr. 464.33
	—	1,720.00	2,977.68	Dr. 1,257.68

Special Deposits Accounts—continued

Name of Account	Balance as at 1st July, 1970	Receipts 1970/71	Payments 1970/71	Balance as at 30th June, 1970
	\$ Cr.	\$	\$	\$ Cr.
<i>Australian Wool Board — Grant for Research (Cont.) —</i>				
Integration of Pasture and Forage Crops on the North West Slopes	—	76,145.00	46,873.74	29,271.26
Supply of Neutron Moisture Meter	—	3,930.75	3,903.25	27.50
Development of Economic Management Approach in Sheep Industry Extension	—	4,095.00	129.24	3,965.76
Development and Field Evaluation of Mathematical Models for Estimating Reproductive Wastage and Fertility in Flock Matings	—	1,850.00	1,278.75	571.25
Joining and Mating Strategies with Sheep	—	6,170.00	3,967.78	2,202.22
Development of Field and Glasshouse Tests for Potassium and Phosphorous	—	11,935.26	8,261.68	3,673.58
Root Disease and the Decline in Subterranean Clover in Southern New South Wales	—	11,550.00	9,073.59	2,476.41
Development of Mechanized Handling Techniques for Baled Hay	—	7,000.00	—	7,000.00
Development of Aerial Pasture Improvement Techniques for Central Districts	—	3,900.00	2,213.37	1,686.63
Training of an Economics Research Officer for Work in the Sheep Industry	—	1,510.00	89.32	1,420.68
Training of a Research Agronomist — Ecology under Grazing of Forage Species in Western Districts	—	1,405.00	—	1,405.00
Evaluation of Pasture and Forage Species — Central West	—	6,665.00	3,895.59	2,769.41
Evaluation of Pasture and Forage Species — North West Plains	—	6,730.00	884.35	5,845.65
Replacement for Post-Graduate Scholar — I.C.R. Holford	—	5,003.92	1,403.92	3,600.00
Purchase of X-Ray Spectrograph and Diffractometer	12,281.83	—	11,170.85	1,110.98
Skin Folds and Ram Fertility	286.50	—	286.50	—
Sheep and Wool Refresher Course — Cobar	—	1,000.00	—	1,000.00
Post-Graduate Scholarship — I.C.R. Holford	—	2,588.00	2,802.59	Dr. 214.59
Post-Graduate Scholarship — P. J. Holst	—	2,800.00	2 800.00	—
Post-Graduate Scholarship — B. J. McGuirk	—	5,559.00	4,569.98	989.02
Post-Graduate Scholarship — M. V. Petruchenia ...	—	2,650.00	2,650.00	—
Post-Graduate Scholarship — G. E. Robards	—	1,400.00	1,400.00	—
Post-Graduate Scholarship — R. J. Roughley	500.00	122.00	622.00	—
Post-Graduate Scholarship — M. H. Campbell	—	1,400.00	1,400.00	—
Post-Graduate Scholarship — B. A. Hamilton	—	934.00	934.00	—
<i>Wheat Industry Research Committee of New South Wales — Grants —</i>				
Air conditioning of Experimental Milling Laboratory	—	4,000.00	—	4,000.00
Breeding of Improved Wheat Varieties for Irrigation Areas	3,738.10	14.15	420.01	3,332.24
Brownlee, H. — Attendance at Grasslands Congress	150.00	—	150.00	—
Continuous Cropping in Southern New South Wales	2,962.15	2,281.92	4,333.52	910.55
Contribution of Legumes to the Productivity of Wheat Soils in Northern New South Wales	943.43	6,828.01	4,991.84	2,779.60
Controlled Environment Chamber for Frost Research	Dr. 251.92	251.92	—	—
Critical Levels of Soil Nitrogen in Southern Wheat Belt	4,368.43	6,385.04	6,841.97	3,911.50
Electronic Grain Counter	215.54	—	—	215.54
Equipment for Breeding for Frost Resistance	10,218.10	12,800.00	20,117.66	2,900.44
Extensions — Laboratories — Agricultural Research Institute, Wagga	8,207.83	—	8,205.00	2.83
Genetic Analysis of Physiological Components of Maturity of Wheat	1,171.75	7,800.00	7,664.69	1,307.06
Growth Development and Yield of Wheat Varieties in relation to date of Sowing and Environment	19,644.77	—	17,073.51	2,571.26
Study of Fertilizer Nitrogen Reactions in Wheat Belt Soils — Wagga	39.24	—	—	39.24
Investigation of Black Soil Scarab	286.13	—	—	286.13
Laboratory Equipment — Wagga Agricultural Research Institute	141.29	—	—	141.29
Pilot Regional Testing Service for Phosphorous on Wheat	1,182.96	5,720.00	5,345.99	1,556.97
Soft Wheat Quality Programme — Central West ...	8.88	—	—	8.88
Soil Factors Associated with Nutrient Deficiencies in Wheat	4,008.78	7,480.00	5,439.26	6,049.52
Wheat/Climate Fertilizer Relations	—	4,250.00	622.31	3,627.69
Soil Nitrogen — Overseas Study — R. R. Storrier .	—	1,500.00	—	1,500.00
Wheat Research in the Central West	Dr. 10,816.95	102,099.00	91,951.00	Dr. 668.95

Special Deposits Accounts—*continued*

Name of Account	Balance as at 1st July, 1970	Receipts 1970/71	Payments 1970/71	Balance as at 30th June, 1971
	\$ Cr.	\$	\$	\$ Cr.
<i>Wheat Research Council Grants —</i>				
Australian Wheat Collection	2,691.59	17,778.40	18,838.21	1,631.78
Equipping of sub-station for Wheat Research	5,001.00	—	4,989.00	12.00
Provision of Auto Analyser for Agronomic and Soil Studies	250.57	235.84	261.41	225.00
Growth Analysis of Wheat in Relation to Developments and the Natural Environment ...	427.42	4,572.00	3,705.99	1,293.43
Improvement of Durum Wheat Varieties	Dr. 3,545.70	17,268.33	11,600.29	2,122.34
Interstate Travel — Mr Banath — Plant Nutrition Conference	—	140.00	140.00	—
Investigation into Possibilities of Segregation of Wheats on the Basis of Quality Wheat Grading Survey	1,698.58	—	—	1,698.58
Laboratory Equipment — Agricultural Research Institute, Wagga	1,793.26	—	—	1,793.26
Overseas Visit (Travel) H. Marcellos	137.00	—	137.00	—
The Chemistry of Soil Nitrogen in Relation to Wheat Production	36.76	—	—	36.76
Seed Counter for Durum Wheat	Dr. 4.00	4.00	—	—
Importation of Norwegian Drill and Austrian Autoheader	3,415.59	—	3,415.59	—
Travel Grant for Integration of Wheat Research ..	Dr. 326.49	1,157.49	890.53	Dr. 59.53
The use of First Generation Hybrid Seed for Commercial Wheat Production	1,068.82	458.98	1,516.70	11.10
Wheat Frost Injury-Biochemistry of Resistance Mechanism	1,504.76	10,640.41	11,971.99	173.18
	\$4,579,906.75	\$14,829,865.36	\$13,710,932.72	\$5,698,839.39

*Commonwealth Grants for State Secondary Schools –
Technical Training Projects*

These funds are made available by the Commonwealth under the States' Grants (Technical Training) Acts. Works under the first triennium (1965/66 to 1967/68) have now been finalised. Works are still in progress under the second triennium (1968/69 to 1970/71).

Below is a summary of receipts and expenditure in respect of these grants:

First Triennium 1965/66 to 1967/68–

Grant received from Commonwealth	\$	800,000
Expenditure to 30th June, 1970	791,689	
Expenditure during 1970/71 –		
Hawkesbury Agricultural College –		
Animal Husbandry Unit	6,621	
Steam line – Dairy to Kitchen	<u>1,690</u>	<u>800,000</u>
Balance of funds on hand		<u>Nil</u>

Triennium Works completed

Second Triennium (1968/69 to 1970/71) –

Grant received from Commonwealth	\$	1,227,000
Expenditure to 30th June, 1970	774,618	
Expenditure during 1970/71		
(a) Buildings–		
Hawkesbury Agricultural College –		
Animal Husbandry Unit	83,587	
Physics Laboratory and Lecture Room	153,322	
P.A.B.X. Switchboard	14,369	
Wagga Agricultural College –		
Animal and Plant Science Laboratory	85,114	
Livestock Demonstration Rooms and Dairy	5,479	
Dairy Buildings	122	
Yanco Agricultural College –		
Accommodation Block	4,251	
Animal Demonstration Block	1,843	
Shearing Shed and Yards	13,843	
(b) Equipment –		
Hawkesbury Agricultural College	918	
Yanco Agricultural College	<u>2,081</u>	<u>1,139,547</u>
Balance of funds available to complete Second Triennium		<u>\$87,453</u>

Commonwealth Grants for Colleges of Advanced Education

Commonwealth legislation provides for grants towards State expenditure on advanced education for courses of instruction which comply with conditions laid down in the Commonwealth Act. These grants are made for three purposes:

- (a) For financing of major capital projects on a \$1 for \$1 basis by the Commonwealth and the State.
- (b) For library purposes in the form of a straight out grant by the Commonwealth.
- (c) For recurrent expenditure. The Commonwealth contributes \$1 for every \$2.85 spent by the State. Thus the Colleges of Advanced Education are run on the basis of funds supplied in the ratio \$1 by the Commonwealth and \$1.85 by the States.

Expenditure on the advanced education programmes is summarised as follows:

(a) *Major Capital Projects:*

First Triennium – 1st January, 1967, to 31st December 1969 –

Total Expenditure	\$	800,930
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Second Triennium – 1st January, 1970, to 31st December, 1972 –

Expenditure to 30th June, 1970	\$	379,005
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Expenditure 1970/71 –

Hawkesbury Agricultural College –

Erection of Poultry Section	19
Residential Accommodation	6,696
School of Food Technology	149,131
Equipment for Cannery	11,388
Alterations to Dairy Technology Buildings	31,073
P.A.B.X System	23,500
Cottage for Lecturer	18,130

Orange Agricultural College –

Student Accommodation	6,461
Administration Building	916
Essential Services	1,306
Roadworks	59,586
Plant and Equipment	7,501
Ancillary Buildings	307
Livestock	16,431
Fencing	2,451

Wagga Agricultural College –

Residential Accommodation	5,524
Animal and Plant Science Laboratories	35,789
Dining Room and Kitchen	124,804
Dairy Buildings	36,186
Cottage for Chief Lecturer	17,070
Roadworks	13,351
Sewerage Treatment Works	158
	<u>946,783</u>

Total Expenditure – both Treinniums – to 30th June, 1971	\$1,747,713
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(b) *Library Grants:*

Hawkesbury Agricultural College –

Expenditure to 30th June, 1970	4,334
Expenditure – 1970/71	<u>352</u>
	4,686

Orange Agricultural College –

Expenditure to 30th June, 1970	Nil
Expenditure – 1970/71	<u>12</u>
	12

Wagga Agricultural College –

Expenditure to 30th June, 1970	3,443
Expenditure – 1970/71	<u>1,342</u>
	4,785
	<u>\$9,483</u>

(c) *Contribution to Recurrent Expenditure:*

An amount of \$579,405 was received from the Commonwealth during 1970/71 as a contribution towards the running costs of Hawkesbury and Wagga Agricultural Colleges. This contribution was at the rate of \$1 for every \$2.85 spent. The contribution is paid direct to the Treasury.

Swine Compensation Fund

A summary of operations on this fund is set out hereunder:

Balance as at 1st July, 1970	768,448
Receipts — Stamp Duty	106,670
	<u>\$875,118</u>
Payments—	
Compensation	8,565
Administration Costs	5,210
	<u>13,775</u>
Balance at 30th June, 1971	<u>\$861,343</u>

Cattle Compensation Fund

Balance at 1st July, 1970	\$1,957,805
Add Receipts—	
Levy	250,586
Stamp Duty	150,693
Interest	72,500
	<u>473,779</u>
	<u>\$2,431,584</u>
Deduct Payments —	
Compensation	400,915
Administration Costs —	
Allowances to Secretaries of Pastures Protection Boards	7,259
Department of Agriculture	15,919
	<u>424,093</u>
Balance at 30th June, 1971	<u>\$2,007,491</u>

The following statistical information is supplied in connection with the payment of \$400,915 as cattle compensation:

Disease	Claims			Animals			Payments		
	Reg 5	Reg 6	Total	Reg 5	Reg 6	Total	Reg 5	Reg. 6	Total
							\$	\$	\$
Tuberculosis	483	88	571	1339	144	1483	67,008.55	13,213.73	80,222.28
Cancer	4133	295	4428	5950	345	6295	208,319.66	22,231.25	230,550.91
Actinomycosis	1641	8	1649	3442	16	3458	63,367.15	1,717.95	65,085.10
Actinobacillosis	525	4	529	653	4	657	24,012.35	439.91	24,452.26
Pleuro pneumonia contagiosa	—	—	—	—	—	—	—	—	—
Trichomoniasis	—	—	—	—	—	—	—	—	—
Tick Fever	—	—	—	—	—	—	—	—	—
Johne's Disease	5	—	5	5	—	5	514.62	—	514.62
Vibriosis	1	—	1	1	—	1	90.00	—	90.00
	6788	395	7183	11390	509	11899	363,312.33	37,602.84	400,915.17

Bovine Tuberculosis and Brucellosis Eradication — Working Account

The Department of Agriculture, as a part of its normal activities, has for some years conducted a Bovine Tuberculosis and Brucellosis control programme. The Commonwealth Government agreed to assist financially in the work and provided a limited amount of assistance in 1969/70 (\$32,200). The Commonwealth provided \$450,000 during 1970/71 and the eradication campaign was intensified. Following is a summary of operations on this account during the year ended 30th June, 1971.

Income—

Funds provided by State	550,000
Funds provided by Commonwealth	450,000
Total funds provided	1,000,000

Expenditure —

Salaries, Wages and Associated Charges	329,621	
Travelling Expenses	19,982	
Rentals	14,557	
Purchase of Plant and Motor Vehicles	17,751	
Stores, Equipment and Minor Expenses	34,038	
Payments to Private Practitioners —		
for T.B. Testing	318,756	
for Brucellosis Vaccinations	249,165	
Administration Costs	15,854	999,724
Balance of funds on hand at 30th June, 1971		276

Commonwealth Extension Services Grant

Commonwealth grants for extension over the previous three years are summarised below:

Item	1968/69	1969/70	1970/71	Total
	\$	\$		
Research Officers	65,075	109,492	138,173	312,740
Extension Officers	156,272	178,738	223,844	558,854
Field Assistants	109,153	134,734	159,097	402,984
Technical and Laboratory Assistants	46,742	70,819	90,866	208,427
Equipment for Officers	217,665	122,092	83,694	423,451
Motor Vehicles	69,100	29,485	49,876	148,461
Buildings	103,829	444,221	175,688	723,738
Agricultural Trainees	-	33,336	23,360	56,696
Materials for Demonstrations	23,850	-	-	23,850
Extension Aids	31,239	20,991	20,738	72,968
Library Services	31,504	15,641	19,523	66,668
Conferences and Study Tours — Overseas	24,572	24,534	23,014	72,120
Grade Herd Recording	71,200	71,200	71,200	213,600
Conferences and Study Tours — Australia	61,185	12,925	10,469	84,579
In Service Training	-	2,681	5,335	8,016
Post Graduate Training	-	4,395	15,975	20,370
Totals	1,011,386	1,275,284	1,110,852	3,397,522

*Assistance to North Coast Dairy Industry —
Feed Year Scheme*

A feed year scheme, to run for a period of five years, was introduced on 1st October, 1966. A summary of operations to 30th June, 1971, appears below:

	Costs \$
1st Scheme Year — commencing 1.10.1966	1,018,960*
2nd Scheme Year — commencing 1.10.1967	650,317
3rd Scheme Year — commencing 1.10.1968	599,410
4th Scheme Year — commencing 1.10.1969	523,876
5th Scheme Year — commencing 1.10.1970	34,819
Total cost to 30th June, 1971	2,827,382

* Includes an amount of \$371,945 for establishment costs which occurred in the First Scheme Year only.

Expenditure during 1970/71 amounted to \$485,136, being payment of claims in respect of:

	Costs
	\$
3rd Year Scheme	1,150
4th Year Scheme	449,167
5th Year Scheme	34,819
	485,136

Noxious Insects Destruction Account

The Noxious Insects Act, 1934, provides for the striking and collection of a levy under certain specified conditions. Moneys received from the levy are paid into a Special Deposits Account and applied by the Minister for the purposes of the Act.

Following is a financial statement of the operations on this account during 1970/71:

Balance as at 1st July, 1970		529,099
Add Receipts —		
Levies	245,586	
Sale of Motor Vehicle	<u>1,315</u>	246,901
		776,000
Less Payments —		
Contribution to Australian Locust Patrol Service	3,850	
Helicopter and Aircraft Hire	19,669	
Insecticide	16,285	
Purchase of Motor Vehicle	1,922	
Materials and Sundry Expenses	<u>3,535</u>	45,261
Balance at 30th June, 1971		730,739

A Treasury advance received in 1969/70 of \$250,000 has not yet been repaid and the true balance at 30th June, 1971, is therefore \$480,739.

Shannon Vale Nutrition Station — Working Account

Following is a statement of receipts and payments on the Shannon Vale Nutrition Station Working Account for the twelve months ended 30th June, 1971:

Balance at 1st July, 1970		28,681
Add Receipts —		
Sale of Wool	3,188	
Sale of Sheep	1,320	
Rental of Cottage	216	
Sale of Assets	<u>25</u>	4,749
		33,430
Less Payments —		
Wages	8,817	
Shearing	682	
Vaccines	283	
Equipment	215	
Purchase of Sheep	1,489	
Fertilizer	660	
General Supplies	1,865	
Extensions to Shearing Shed	<u>1,985</u>	15,996
Balance at 30th June, 1971		17,434

Australian Inoculants Research and Control Service — Working Account

Following is a statement of receipts and payments for the above account for the year ended 30th June, 1971:

Receipts —

Contributions for Services

New South Wales	7,000
Victoria	3,000
Queensland	3,700
South Australia	2,500
Western Australia	8,000
Tasmania	<u>1,500</u>

Contributions for Building

Department of Primary Industry	10,000	
Reserve Bank	10,000	45,700

Less Payments –

University of Sydney for service to 31st January, 1971	4,738	
Salaries	4,037	
Travelling Expenses	222	
Operating Expenses	2,996	
Equipment	666	
Laboratory Building	21,221	33,880

Balance at 30th June, 1971

11,820

The administration of the Australian Inoculants Research and Control Service was taken over from Sydney University on 1st July, 1970. Laboratory Buildings were erected at Rydalmere for this work, but because the laboratories were not completed until January, 1971, the University carried out the necessary laboratory work until 31st January, 1971, and were repaid for salary costs incurred.

**STATEMENT OF RECEIPTS – CONSOLIDATED REVENUE FUND –
FINANCIAL YEAR ENDED 30th JUNE, 1971**

Head of Receipt	Net Receipts	
	\$	\$
Receipts for Services Rendered –		
Agricultural Colleges and Farms –		
Rents	74,386	
Students' Fees	205,828	280,214
Fees –		
Jurors' Fees	43	
Witnesses' Expenses	97	
Examination Fees	100	
Apiary Registrations	5,120	
Grading – Dairy Industry Act	103	
Registration – Dairy Industry Act	58	
Dairy Science Schools	958	
Farm Produce Agents' Act	550	
Fertilizer Act	1,843	
Pest Destroyers Act	3,394	
Poultry Processing Act	345	
Registration of Stock Brands	6,790	
Registration of Swine Brands	491	
Stock Foods and Medicines Act	7,371	
Veterinary Surgeons' Act	4,197	31,460
Contributions –		
Commonwealth Government –		
Administration of Plant Quarantine	337,268	
Administration of Animal Quarantine	179,298	
Administration of Commerce Act	95,995	
Maintenance of Gardens – Admiralty House	20,586	633,147
Miscellaneous Services Rendered –		
Plant Diseases Act – Inspection Fees	638	
Meat Industry Act – Inspection Fees	1,300,647	
C.S.I.R.O – Subsidy of Vegetable Growing at Hawkesbury Agricultural College	500	
Herd Recording Fees	214,434	
Seed Testing and Certification Fees	28,926	
Administration Costs – Cattle Compensation	15,919	
Administration Costs – Swine Compensation	5,210	
Commission for Collection of Premiums	7,746	
Other Miscellaneous Receipts	82,281	1,656,301
Total – Receipts for Services Rendered		2,601,122
General Miscellaneous Receipts –		
Rents exclusive of Land	16,154	
Fines and Forfeitures	31,283	
Miscellaneous Receipts on account of Interest	825	
Sale of Farm Produce and Livestock	395,436	
Sale of Government Property	21,924	
Commonwealth Government Contribution for Cattle Tick Control	387,589	
Repayment to credit of Consolidated Revenue Fund – Previous Years	177,143	
Transfers of Part Balances – not required	276	
Pastures Protection Boards – 3 per cent Contributions	75,095	
Employer's Liability to State Superannuation Fund	108,579	
Commonwealth Grant towards cost of Herd Recording	71,200	
Commonwealth Contribution under States' Grants (Advanced Education) Act	579,405	
Other Miscellaneous Receipts	7,306	1,872,215
GRAND TOTAL – all revenue		<u>4,473,337</u>

MISCELLANEOUS ACCOUNTS

Veterinary Surgeons' Act, 1923 (as amended)

The Act provides for the establishment of a Board of Veterinary Surgeons of New South Wales. Fees and penalties collected are paid to the credit of Consolidated Revenue Fund from which the administrative expenses of the Board are met.

Following is a statement of receipts and payments for the year ended 30th June, 1971:

<i>Receipts</i>		<i>Payments</i>	
	\$		\$
Roll Fees	3,591	Salaries	2,212
Registration and Restoration Fees	436	Board Fees	766
Approval to Practice under supervision Fees	40	Examiners' Fees	225
Examination Fees	120	Printing	818
Miscellaneous	10	General Expenses	386
Excess of Payments over Receipts	210		
	4,407		4,407

There were 884 registered Veterinary Surgeons and 17 persons were practising under supervision at 30th June, 1971.

Meat Inspection Service

The Meat Inspection Service is administered by virtue of the Meat Industry Act, 1915, which makes provision for a scale of Inspection Fees.

Following is a statement of receipts and payments in connection with the service for the twelve months ended 30th June, 1971:

<i>Receipts</i>		<i>Payments</i>	
	\$		\$
Inspection Fees —		Salaries and Wages	1,234,717
Regulation No. 7	110,789	Casual Labour	10,305
Regulation No. 8	134,844	Allowances	766
Regulation No. 9	184,799	Retirement Leave	1,429
Regulation No. 9B	804,961	Overtime	18,197
Regulation No. 10	65,254	Metropolitan Meat Industry Board Endowment Fund Contribution	7,071
		Rent	1,720
		Travelling Expenses	72,371
		Motor Vehicle Running Costs	323
		Freight and Cartage	337
		Books and Periodicals	142
		Postal and Telephone Expenses	1,548
		Fees for Services Rendered	412
		General Stores	7,810
		Gas and Electricity	111
		Printing	712
Excess of Payments over Receipts	57,324		
	1,357,971		1,357,971

Overhead expenses, calculated at 20% of the cost of wages and salaries, to cover Workers' Compensation Insurance premiums, Payroll Tax and Employer's Superannuation Contributions, should also be taken into account. This overhead amounts to \$246,943 (20% of \$1,234,717), and when added to the deficiency of \$57,324 shown above indicates that the cost of this service, not covered by fees received, amounted to \$304,268 for 1970/71.

**FUND CREATED BY THE WHEAT MARKETING (BARRING OF CLAIMS)
ACT, 1929**

Revenue Account for the year ended 30th June, 1971

	\$		\$
To Commitments entered into during 1970/71	5,367	By Interest on Investments (including Savings Bank Interest)	5,439
To Surplus transferred to Accumulated Funds	72		
	<u>\$5,439</u>		<u>\$5,439</u>

Balance Sheet as at 30th June, 1971

<i>Liabilities</i>	\$	<i>Assets</i>	\$
Accumulated Funds —		Investments in Government Securities (at face value)	103,000
Balance at 1st July, 1970	\$103,638	Commonwealth Savings Bank	4,679
Add uncommitted Revenue	72	Accrued Interest	1,067
	103,710		
Outstanding Commitments at 30th June, 1971	5,036		
	<u>\$108,746</u>		<u>\$108,746</u>

DAIRY PRODUCTS FACTORY — HAWKESBURY AGRICULTURAL COLLEGE

The operations of the Dairy Products Factory for the financial year ended 30th June, 1971, resulted in a net loss of \$60,547. This compares with a net loss of \$29,262 in 1969/70 and a net loss of \$41,932 in 1968/69. The higher loss in 1970/71 was caused by the necessity to close down all sections of the factory during renovations and the laying of new tile floors. The Market Milk Section was out of operation for almost four months and during this period the milk bottling was done elsewhere, involving the College factory in additional costs for processing and cartage.

Following are the abridged accounts for 1970/71.

Manufacturing and Trading Account for the year ended 30th June, 1971

	\$		\$
Stock on hand at 1st July, 1970	15,483	Sales	348,535
Purchases	281,464	Stock on hand at 30th June, 1971	13,845
Repairs and Maintenance	22,632		
Fuel, Light and Power	7,637	Gross Loss transferred to Profit and Loss Account	20,646
Water	2,875		
Salaries and Wages	33,302		
Depreciation	19,238		
Sundry Costs	395		
	<u>383,026</u>		<u>383,026</u>

Profit and Loss Account for the Year ended 30th June, 1971

	\$		\$
Gross Loss from Trading Account	20,646	Net loss for year ended 30th June, 1971	60,547
Salaries and Wages	9,790		
Employer's Contribution to Superannuation	2,998		
Payroll Tax	1,153		
Workers' Compensation Insurance	643		
Levies — Butter and Cheese	556		
Depreciation	1,093		
Loss on Sale of obsolete Plant	3,683		
Freight and Cartage	613		
General Expenses	291		
Laboratory Expenses	1,235		
Printing and Stationery	50		
Interest	17,796		
	<u>60,547</u>		<u>60,547</u>

APPENDIX II

PUBLICATIONS 1970–1971

The publications listed have been classified as: Department of Agriculture (D. of A.) bulletins, booklets, leaflets; contributions to journals, including the Department's journals — the *Agricultural Gazette of New South Wales*, the *Review of Marketing and Agricultural Economics*, *Dairy Topics*, *Poultry Notes* and *Veterinary Notes* — as well as journals of other organizations; papers presented at technical conferences for which there are published records; and theses presented for higher degrees.

The Appendix does not list the much greater volume of items published as news and information releases for press, radio and television, newspaper supplements and newsletters for specific areas or groups of primary producers.

DIVISION OF RESEARCH STATIONS

Contributions to Journals

- Finlayson, W. H. (1970). How to reduce rice header losses. *Ricemills News* 7(4): 21.
- Garland, P. J. (1970). Grain drying. I.R.E.C. Farmers Newsletter, Large Area Edition 78: 4–6.
- Garland, P. J. (1971). Introduction to grain drying. I.R.E.C. Farmers Newsletter, Large Area Edition 75: 5–9.
- Garland, P. J., Spencer, R. T. and McMaster, G. S. (1970). Tillage and tillage implements *Agric. Gaz. N.S.W.* 81(9): 482–92.
- Pharoah, D. M. (1970). Rust costs money. *Agric Gaz. N.S.W.* 81(10): 551.

Contributions to Technical Conferences

- Drever, J. G. J. and Holligan, P. J. (1970). Grain aeration. Review paper. *Proc. Aust. Cereal Agronomists' Conf.*: 8(c), 10–13.
- Drever, J. G. J. (1970). Harvesting drying and storage of grain. Review paper. *Proc. Aust. Cereal Agronomists' Conf.*: 8(c), 1–10.

Other Publications

- Finlayson, W. H. (1970). Orchard sprayer maintenance. Orchard spray calendar 1970/71, 10: 21–3. Pub. United Farmers' & Woolgrowers' Assoc.
- Whiston, W. D. (1970). Australian national machinery field days programme and catalogue of farm machinery. Central Western Daily Press, 184 pages.

DIVISION OF PLANT INDUSTRY

D. of A. Bulletins, Booklets, Leaflets

- Anon. (1970). Vegetable growing guide. Bull. P.5.
- Anon. (1970). Mesquite, a threat to western grazing land. Bull. P.330c.
- Auld, B. A. (1970). Crofton weed. Bull. P.180.
- Auld, B. A. (1970). Groundsel bush. Bull. P.405.
- Bagshaw, F. A. (1970). Control of onion weed, nut grass and oxalis in home gardens. Bull. P.413.
- Bagshaw, F. A. (1970). Notes on lawn culture. Bull. P.319.
- Bagshaw, F. A. (1970). Some native shrubs for home gardens. Bull. P.417.
- Bagshaw, F. A. (1971). Growing tomatoes in the home garden. Bull. P.225.

- Boerema, E. B. (1970). Nitrogen for rice in N.S.W. Bull. P.411.
- Boyle, A. J. (1970). Seepage tanks —irrigation in Upper Hunter drought. Bull. P.418.
- Colless, J. M. (1970). Easier production of hybrid maize seed. Bull. P.406.
- Fishpool, K. I. (1970). Controlling African boxthorn with fenuron and bromacil. Bull. P.421.
- Fishpool, K. I. (1970). Working out fertilizer rates and costs. Bull. P.410.
- Johnson, R. I. (1970). Grain sorghum plant and row spacings. Bull. P.380.
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Contributions to Technical Conferences

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- Turner, D. W. and Barkus, B. (1970). Leaf sampling method studies in bananas. Proc. Aust. Plant Nut. Conf., Mt Gambier, 4(a): 15.
- Weir, R. G. (1970). Molybdenum content of maize seed. Proc. Aust. Plant Nut. Conf., Mt Gambier, 2(a): 22.
- Weir, R. G. and Craddock, F. W. (1970). Leaf analysis as an assessment of magnesium status of citrus. Proc. Aust. Plant Nut. Conf., Mt Gambier, 4(a): 11.

BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE

(iii) Entomology Branch

Contributions to Journals

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- Anon. (1970). Codling moth, *Cydia pomonella*. Agric. Gaz. N.S.W. 81(9): back cover.
- Anon. (1970). White wax scale, *Gascardia destructor*. Agric. Gaz. N.S.W. 81(10): back cover.
- Anon. (1970). Ground beetles. Agric. Gaz. N.S.W. 81(11): 613.
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ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

Book

- Pryor, L. D. (Aust. Nat. Univ.) and Johnson, L. A. S. (1971). A classification of the eucalyptus. Aust. Nat. Univ. Press. 102pp.

Contributions to Journals

- Beard, J. S. (1970). The penetration of the western deserts of Australia. Geographical J. 136: 557.
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- Evans, O. D. (1970). Some observations on the Lemnaceae or "Duckweeds" of New South Wales. Contrib. N.S.W. Nat. Herb. 4: 87.
- Johnson, L. A. S. (1970). Rainbow's end: the quest for an optimal taxonomy. Reprinted with addendum, Syst. Zool. 19: 203. (Originally pub. in Proc. Linn. Soc. N.S.W., 1968).
- Johnson, L. A. S. and Briggs, B. G. (1971). Unplanted trees — the value of natural regrowth. Agric. Gaz. N.S.W. 82(1): 34.

- Lee, A. T. (1970). Taxonomic notes on *Platylobium*, *Bossiaea* and *Templetonia* in New South Wales. Contrib. N.S.W. Nat. Herb. 4: 96.
- May, V. (1970). New or interesting algal records from Australia. Contrib. N.S.W. Nat. Herb. 4: 79.
- May, V. (1970). A toxic alga in New South Wales and its distribution. Contrib. N.S.W. Nat. Herb. 4: 84.
- McGillivray, D. J. (1970). A checklist for the illustrations of the botany of Cook's first voyage. Contrib. N.S.W. Nat. Herb. 4: 112.
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- Tindale, M. D. (1970). Notes on Australian taxa of *Acacia*, No. 2. Contrib. N.S.W. Nat. Herb. 4: 137.
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Contributions to Technical Conferences

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- Beard, J. S. (1971). The vegetation survey of Western Australia — some problems in small-scale mapping of large areas. 43rd ANZAAS Congr., Brisbane.

DECENTRALIZED AGRICULTURAL RESEARCH DIRECTORATES

(i) Agricultural Research Institute, Wagga Wagga

Contributions to Journals

- Pugsley, A. T. (1971). A genetic analysis of the spring-winter habit of growth in wheat. Aust. J. Agric. Res. 22(1): 21.
- Pugsley, A. T. (1970). What the wheat breeders are doing. Bulk Wheat 4: 12.
- Storrier, R. R., Hanly, A. T., Spence, T. B. and Smith, A. N. (1971). Wheat yields and indices of available soil nitrogen in southern New South Wales — a preliminary evaluation. Aust. J. Exp. Agric. Anim. Husb. 11(50): 295.

Contributions to Technical Conferences

- Campbell, A. P., Burrows, F. J. and Kohn, G. D. (1971). Leaf area, leaf diffusive resistance and evaporation from wheat. 43rd ANZAAS Congr., Brisbane.
- Taylor, A. C. (1970). The prediction of silo protein levels in southern New South Wales. Proc. Aust. Cereal Agron. Conf., Wagga, 6: 13.
- Taylor, A. C. (1970). Comparative yields of Heron, Olympic and Falcon wheats in southern New South Wales. Proc. Aust. Cereal Agron. Conf., Wagga, 7(a): 16.

(ii) Agricultural Research Directorate, Tamworth

Contributions to Journals

- Banath, C. L. (1970). A suggested physiological method for ascertaining the nutrient status of plants. J. Aust. Inst. Agric. Sci. 36: 243.
- Banath, C. L. (1971). Results of a physiological and leaf area method of assessing the nutrient status of clover. J. Aust. Inst. Agric. Sci. (in press).
- Evans, G. (1971). Influence of weed hosts on the ecology of *Verticillium dahliae* in newly cultivated areas of the Namoi Valley, N.S.W. Ann. Appl. Biol. 67: 169.
- Holland, J. F. and Evans G. (1971). Virus disease of sorghum. Sorghum Newsletter 14: 11.
- Marcellos, H. and Single, W. V. (1971). Quantitative responses of wheat to photoperiod and temperature in the field. Aust. J. Agric. Res. 22: 343.

Contributions to Technical Conferences

- Banath, C. L. (1970). Iron pyrites as a sulphur fertilizer and its cost comparative to elemental sulphur. Working papers, Aust. Plant Nut. Conf., Mt Gambier, 1(d): 14.
- Banath, C. L. (1970). A possible physiological method of ascertaining the nutrient status of plants. Working papers, Aust. Plant Nut. Conf., Mt Gambier, 4(a): 1.
- Banath, C. L. (1970). A comparison of results of a physiological and leaf area method of assessing the nutrient status of subterranean clover with field experiment results. Working papers, Aust. Plant Nut. Conf., Mt Gambier, 4(a): 1.
- Banath, C. L. and Single, W. V. (1970). Effects of sulphur and nitrogen deficiencies on freeze resistance in wheat plants. Working papers, Aust. Plant Nut. Conf., Mt Gambier, 1(c): 6.
- Banath, C. L. and Single, W. V. (1970). Effects of stem freezing in wheat plants on phosphorus and nitrogen translocation and on the other grain parameters. Working papers, Aust. Cereal Agron. Conf., Wagga Wagga, 2(b): 19.
- Evans, G. (1970). Studies on the pre-infection phase of diseases caused by *Verticillium dahliae*. Working papers, Soil Biol. Conf., Adelaide: 38.
- Single, W. V. and Matheson, E. M. (1970). A combine harvester for small plots. Working papers, Aust. Cereal Agron. Conf., Wagga Wagga, 7(b): 10.
- Single, W. V., Marcellos, H. and Doyle, A. D. (1970). Frost injury and wheat yield. Working papers, Aust. Cereal Agron. Conf., Wagga Wagga, 2(b): 21.
- Symes, K. (1971). Storage (A) Factors affecting life span, and (B) Techniques for maintaining seed viability both in commercial and experimental size lots. Working papers, Aust. Seeds Res. Conf., Mt Gambier.

(iii) Agricultural Research Station, Wollongbar

Staff under the direction of the Director of Research, Agricultural Research Station, Wollongbar are positioned at this Station by various Divisions of the Department. Therefore, their publications are listed elsewhere in this Appendix, under the appropriate Divisional heading. (Division of Plant Industry, Division of Animal Industry, Division of Marketing and Economics, or Biological and Chemical Research Institute, as the case may be).

DIVISION OF MARKETING AND ECONOMICS

D. of A. Bulletins, Booklets, Leaflets

- Benson, R. J. (1971). Development of the steeper slopes and ridge country in Kyogle district. D.M.A.E. Farm Planning Leaflet No. 22.
- Benson, R. J., Standen, B. J., Christiansen, T. J. and Hardy, F. H. (1971). Budgeting beef cattle property development. D.M.A.E. Farm Planning Leaflet No. 21.
- Coomber, B. B. (1971). Development costs for Murrumbidgee Irrigation Area wine grapes. Leeton Econ. Inf. Series.
- Hodgkinson, Sally A. (1970). A report of case studies of prune production. D.M.A.E. Farm Planning Leaflet No. 19.
- Hodgkinson, Sally A. and Simpson, P. C. (1970). Pea growing in the Oberon district. D.M.A.E. Farm Planning Leaflet No. 20.
- Hodgkinson, Sally A. (1971). Case studies of prune production on the Murrumbidgee Irrigation Area and at Young. Part I — Financial results. D.M.A.E. Misc. Bull. No. 13.
- Hodgkinson, Sally A. (1971). Case studies of prune production on the Murrumbidgee Irrigation Area and at Young. Part II — Prune enterprise gross margins. D.M.A.E. Misc. Bull. No. 14.
- Kennedy, J.R. (1971). Irrigated soya beans for southern N.S.W. Leeton Econ. Inf. Series.
- Kennedy, J. R. (1971). Irrigated sunflowers for the Murrumbidgee Irrigation Area. Leeton Econ. Inf. Series.

- Martin, K. J. (1971). Sheep gross margins. Wagga Occasional Econ. Series No. 1.
- Rance, G. A. (1970). The Commonwealth Drought Bonds. Goulburn Econ. Inf. Series.
- Rance, G. A. (1971). Decision making under uncertainty — a practical example. Goulburn Econ. Inf. Series.
- Randall, A. J. (1970). Management data and enterprise budgets for Berrigan Irrigation District farms. D.M.A.E. Misc. Bull. No. 12.
- Sibree, J. M. (1970). Index of rural credit. Wagga Occasional Econ. Series No. 2.
- Sibree, J. M. (1971). Costs and returns for wheat, oats, barley, rape, lupins and field peas. Wagga Occasional Econ. Series. No. 3.
- Sibree, J. M. (1971). How much does it cost to start in pig farming. Wagga Occasional Econ. Series. No. 4.

Contributions to Journals

- Benson, R. J. and Allen, R. N. (1970). Controlling leaf diseases of bananas. Agric. Gaz. N.S.W. 81(10): 558.
- Christiansen, T. J. (1971). Alternative use of dairying land. Agric. Gaz. N.S.W. 82(2): 89.
- Christiansen, T. J. (1971). Adjustments to resources formerly used for dairying. Rev. Marktg. Agric. Econ. 39(2): 127.
- Gallagher, D. R. (1971). Why promote farm products. Agric. Gaz. N.S.W. 82(3): 149.
- Hodgkinson, Sally A., Tucker, J. J. and Simpson, P. C. (1971). Intensive pasture management for sheep in central tablelands. Agric. Gaz. N.S.W. 82(2): 66.
- O'Meagher, P. J. D. (1971). Farm records and the farm wife. Agric. Gaz. N.S.W. 82(3): 182.

Contributions to Technical Conferences

- Richmond, R. N. (1971). The economics of additional public investment in existing irrigation. 43rd ANZAAS Congr., Brisbane.

DIVISION OF EXTENSION SERVICES

Contributions to Technical Conferences

- Ament, B. D. (1971). Leadership, supervision, administration. Proc. Nat. Workshop on Ext. Prog. Planning, Sydney.
- Ament, B. D. (1970). Can show societies be more active in agricultural extension? Proc. Agric. Soc. Council Seminar, Sydney.
- Boerema, E. B. and Tindale, E. (1970). The flow of communication in extension and adoption of research findings in the N.S.W. rice industry. Proc. A.I.A.S. Ext. Conf., Melbourne, 2: 133.
- Harrison, H. T. (1970). Co-operative planning and extension co-ordination in a N.S.W. region. Proc. A.I.A.S. Ext. Conf., Melbourne, 1: 153.
- Potter, J. N. (1971). Programme planning in agricultural extension. Proc. Nat. Workshop on Ext. Prog. Planning, Sydney.
- Potter, J. N. and Slater, J. J. (1970). Experience in planning extension work. Proc. A.I.A.S. Ext. Conf., Melbourne, 1: 185.
- Robson, J. K. (1970). Adoption of recommendations in a crisis situation. Proc. A.I.A.S. Ext. Conf., Melbourne, 1: 79.
- Slater, J. J. (1971). Programme planning in N.S.W. Proc. Nat. Workshop on Ext. Prog. Planning, Sydney.
- Tindale, E. and Boerema, E. B. (1970). Organization of extension and research in the N.S.W. rice industry. Proc. A.I.A.S. Ext. Conf., Melbourne, 1: 7.

Hawkesbury Agricultural College

Dairy Research Laboratories and Agronomy Research Section publications appear within their respective Divisional lists.

D. of A. Bulletins, Booklets, Leaflets

- Holbeche, J. A. (1971). Cropping and quality characteristics of some new dessert peach varieties at Bathurst, N.S.W. Sci. Bull. No. 81.
- Bird, J. G. and Macadam, R. D. (1971). Final report of the workshop on programme planning in rural extension work. Occasional Bull. No. 1, School of Rural Ext.
- Bird, J. G. (1971). Report on the first year of the Hawkesbury Diploma in Rural Extension. Occasional Bull. No. 2, School of Rural Ext.

Contributions to Journals

- Pattie, W. A., Williams, L. G. and Dettman, Belinda E. (1970). Selection for improvement of economic returns from weaner cattle. Proc. Aust. Soc. Anim. Prod. 8: 115.
- Williams, L. G., Kirton, H. C., Pattie, W. A. and Garnock, J. G. (1970). Relative economic values of beef cattle traits for use in selection programmes. Proc. Aust. Soc. Anim. Prod. 8: 109.
- Yates, W. J. and Pattie, W. A. (1970). The effect of genetic improvement within pure breeds on performance of their crossbred lambs. Proc. Aust. Soc. Anim. Prod. 8: 154.

Contributions to Technical Conferences

- Baumgartner, P. A. (1971). Principles of food preservation. Proc. 12th Winter School, Food Tech. Assoc. N.S.W.
- Bird, J. G. (1971). System design and some group dynamics considerations in the development of an adult education training programme. Conf. on Small Group Learning, A.N.U., Canberra, May.
- Macadam, R. D. (1970). Communication and methods. Review paper, A.I.A.S. Ext. Conf., Melbourne.

Other Publications

- Baumgartner, P. A. (ed.) (1971). Proceedings of meat quality control school, 1971. Prod. by Aust. Meat Board and Hawkesbury Agric. Coll.
- Baumgartner, P. A. (ed.) (1971). Proceedings of smallgoods manufacturing workshop, 1971. Prod. by N.S.W. Meat and Allied Trades Fed. and Hawkesbury Agric. Coll.

BIOMETRICAL BRANCH

Contributions to Journals

- Batterham, E. S., Manson, M. B. and Kirton, H. C. (1970). A nutritional evaluation of diets containing meat meal for growing pigs. 4. Differences in growth of pigs on different meals and in chemical and chick tests of these meals. Aust. J. Exp. Agric. Anim. Husb. 10(45): 384.
- Saville, D. G., Gleeson, A. C. and McManus, W. R. (1971). Drought feeding of sheep. 1. Wool growth and body weight responses to protein supplementation of grain based diets in three strains of Merinos. Aust. J. Exp. Agric. Anim. Husb. 11(49): 148.
- Storrier, R. R., Hanly, A. T., Spence, T. B. and Smith, W. H. (1971). Wheat yields and indices of available soil nitrogen in southern New South Wales — a preliminary evaluation. Aust. J. Exp. Agric. Anim. Husb. 11(50): 295.

APPENDIX III

STAFF AND PERSONNEL BRANCH NOTES

(Central Administration)

STAFF SECTION

Salary Agreements Determinations, Awards Processed.

During the year, 6 new Awards, 19 Agreements and 20 Determinations in respect of salaries costing an additional \$2,583,069 per annum were processed.

Staff and Trainee Numbers.

Variations in staff establishment figures and trainee numbers during the year, may be summarised thus:

	Establishment at 30.6.1979	Establishment at 30.6.1971
Professional	878	920
Administrative and Clerical	553	569
General Division	1,419	1,477
Ministerials	965	993
Uni. and College Trainees	252	231
	<u>4,067</u>	<u>4,190</u>

New Appointments, Retirements, Promotions etc.

Senior Positions Created

Central Administration — Assistant Director-General; Senior Research Officer (Survey Ecology). *Division of Marketing and Economics*. — Special Economists (Surveys). *Division of Dairying*. — Assistant Principal Dairy Officer (Regulatory). *Division of Research Stations*. — Assistant Principal Officer (Drought Relief). *Agricultural Colleges*. — Lecturers — four at Hawkesbury Agricultural College, four at Wagga Agricultural College and one at C. B. Alexander Agricultural College; Principal Designate, Hawkesbury Agricultural College; and Secretary, Wagga Agricultural College.

Senior Appointments

Dr J. S. Beard, Director and Chief Botanist, Royal Botanic Gardens; P. C. Druce, Deputy Chief, Division of Marketing and Economics to Chief, Division of Marketing and Economics; J. W. Elston, Senior Economist to Principal Extension Economist; K. W. R. Gilchrist, Senior Livestock Officer (Beef Cattle and Horses) to Principal Livestock Officer (Beef Cattle and Horses); C. R. Hood, Assistant Principal Officer (Management) to Principal Officer (Management); R. J. Jessup, Assistant Principal Agronomist (Research) to Executive Assistant to Senior Deputy Director-General; D. Leggo, Assistant Principal Fruit Officer (Research) to Principal Fruit Officer (Research); I. J. Lewis, Research Officer to Director, Cattle Tick Research Station, Wollongbar; Dr D. E. Maccallum, Senior Economist to Deputy Chief, Division of Marketing and Economics; E. G. McLaren, Principal Dairy Officer (Extension) to Deputy Chief, Division of Dairying; J. N. Potter, Principal Extension Officer (Extension Research/Evaluation); D. R. Scott, Principal Dairy Officer (Herd Improvement) to Principal Dairy Officer (Extension), Division of Dairying; Dr G. J. Smith, Deputy Chief, Division of Dairying to Chief, Division of Dairying.

Special Reclassifications

D. K. Bartels, Executive Officer to Secretary, Hawkesbury Agricultural College; N. W. A. Bennett, Senior Livestock Officer (Sheep and Wool) to Special Livestock Officer (Fine Wool Production); G. G. Darling, Senior Livestock Officer (Sheep and Wool) to Special Livestock Officer (Sheep Management and Pasture Utilisation); R. H. Falk, Veterinary Officer to Assistant Principal Veterinary Research Officer; I. R. Littlejohns, Veterinary Officer to Assistant Principal Veterinary Research Officer; M. J. Tucker, Senior Livestock Officer (Sheep and Wool) to Special Livestock Officer (Prime Lamb Production).

The Public Service Board approved of the following special reclassifications: Dr D. G. Fowler, B.Sc., Ph.D., Livestock Research Officer, as Research Scientist; Dr B. J. Restall, B.Sc., Ph.D., Livestock Research Officer, as Research Scientist; and Dr R. J. Roughley, B.Sc. Agr., M.Sc. Agr., Ph.D., Bacteriologist, as Senior Research Scientist.

Retirements

J. E. H. Brill, Seed Production Officer; K. V. Byrne, Veterinary Officer; C. M. Huie, Field Assistant; C. J. King, Chief, Division of Marketing and Economics; T. H. McDonald, Inspector Plant Diseases Act; W. J. B. Murphy, Principal Livestock Officer (Beef Cattle and Horses); M. F. Napier, Senior Inspector of Accounts; J. B. Owen, Officer-in-Charge, Central Secretariat; L. R. Peirce, Foreman; Mrs H. Pont, Stenographer; W. H. Rogan, Farm Foreman; P. S. Slade, Field Assistant.

Deaths

J. M. Arthur, Farm Supervisor, Hawkesbury Agricultural College; M. G. Chatfield, Chemist; G. F. Corney, Clerk, Central Secretariat; P. B. Dawson, Garden Labourer; W. Farrier, House Services Officer, Hawkesbury Agricultural College; B. W. Greenaway, Farm Foreman, Poultry Research Station, Seven Hills; H. L. Hobson, Farm Foreman, Wagga Agricultural College; J. King, Garden Labourer; E. C. Powell, Principal Officer (Management); J. I. Thomson, Lecturer.

Promotions

The number of promotions in 1969–70 and 1970–71 are compared below:

	1969–70	1970–71
Officers promoted during the year	179	187
Officers promoted out of seniority order	<u>73</u>	<u>97</u>
Total number promoted during the year	<u>252</u>	<u>284</u>

Officers Undertaking or About to Undertake Post-Graduate Study Within Australia

The following professional officers were at universities within Australia working towards higher degrees in subject matter areas appropriate to the Department's responsibilities: T. S. Abbott, Chemist, 3 years from March 13, 1967, to July 22, 1970, on a Commonwealth Research Studentship at the University of Sydney; E. S. Batterham, Livestock Research Officer, 3 years from October 27, 1970, at the University of Melbourne to undertake studies towards Ph.D. with expenses and fees from the Commonwealth Extension Services Grant; K. J. Beh, Veterinary Officer, 3 years from January 18, 1971, at the University of Sydney on an F. H. Loxton Post-graduate Studentship for study leading towards Ph.D.; K. G. Beirne, Lecturer at the Waite Agricultural Research Institute, South Australia for the 1970 academic year to undertake post-graduate studies; M. H. Campbell, Agronomist, 3 years from January, 1968 on a Wool Board Scholarship for studies leading towards Ph.D. at the University of New England; A. D. Clift, Entomologist, 3 years from March 10, 1969, on a Commonwealth Research Studentship toward Ph.D. at the University of Sydney; E. J. Cother from February, 1970 to December, 1970 to study for Ph.D. at the University of Sydney; F. R. Doughty, Veterinary Research Officer, for 3 years from January, 1970, to undertake post-graduate training at the University of Sydney; B. M. Freeman, Agronomist, undertaking research into the efficiency of the drip concept of irrigation at the CSIRO Irrigation Research Station, Griffith from April, 1970, to June, 1971; A. C. Gleeson, Biometrician, March 19, 1971, to July 1, 1971, at the University of New South Wales for the completion of studies for the degree of Master of Statistics on a Commonwealth Post-graduate Scholarship; E. A. Hamilton, Livestock Research Officer, for 2 years — September, 1967, to August, 1970 — to study towards Ph.D. on a Wool Board Scholarship at the University of New England; H. Hearnshaw, Livestock Research Officer, 3 years from 1970 for Ph.D. studies at the University of Melbourne; P. J. Holst, Livestock Research Officer, up to 3 years from February 1, 1969, for post-graduate training at the School of Biological Sciences, Macquarie University; E. R. Hunt, Veterinary Officer, 2 years from February 15, 1971, at the University of Sydney for post-graduate studies on an Australian Meat Research Committee award; P. W. Lynch, Lecturer, awarded R.A.S. Travel Scholarship to study pasture and crop production for beef cattle at Agricultural Colleges in Queensland from May 9 to May 30, 1971; P. T. Mears, Agronomist, for 2 years from June, 1969 to study for Ph.D. at the University of Queensland; P. J. Milham, Chemist, from June, 1969, for up to 5 years to undertake Ph.D. studies at Macquarie University; J. M. Morgan, Research Agronomist, 3 years from 1970 to undertake Ph.D. studies at Macquarie University; M. V. Petruchenia, Extension Officer, from March 2, 1970, to December 31, 1971 to undertake study towards an M.Sc. degree at the University of New South Wales; L. C. Pryde, Livestock Officer (Sheep & Wool) from March, 1969, awarded traineeship in Veterinary Science at the University of Sydney; G. E. Robards, Livestock Officer (Research) 3 years from January, 1968, to January, 1971 for post-graduate studies towards a Ph.D. at the University of Melbourne; H. B. Roberts, Veterinary Research Officer, awarded Research Fellowship for 3 years from June, 1971, by the Commonwealth Development Bank for studies leading towards award of Ph.D. at the University of Sydney; K. J. Roe, Veterinary Officer, February 26, 1971, to December 17, 1971, at the University of New England, Armidale, to study for a Diploma in Agricultural Economics on an award by the Australian Meat Research Committee; W. Roham-Jones, Livestock Research Officer, from February 9, 1969, for 3 years for a biological study at the University of New England; A. W. Smith, Senior Research Officer, 2 years from January 20, 1971, at the Institute of Agriculture, University of Western Australia, studying for Ph.D.; E. Seif, Research Officer, at the University of Sydney for the 1970 academic year for post-graduate studies; J. P. Warnock, Agronomist, awarded an R.A.S. Travel Scholarship in Irrigation Engineering to visit specified centres in all states; D. L. Watson, Livestock Officer, to study for Ph.D. at the University of Sydney from February, 1970, for 3 years.

Officers Officially Overseas for Post-graduate Studies.

The following professional officers were overseas for post-graduate study: R. N. Allen, Plant Pathologist, 2 years from February 13, 1971 at the University of Auckland, New Zealand, for studies leading towards Ph.D. on an award from the New Zealand Commonwealth Scholarship Committee; R. B. Bonner, Veterinary Officer, from September 15, 1969, to January 28, 1971 to visit centres in Europe and U.K. and study at the University of London. R. W. J. Bowen, Agronomist, 2 years from June, 1971 at the University of Wageningen, Holland to study for M.Sc. following the award of a Rotary International Foundation Scholarship; J. W. Freebairn, Economist, 3 years from September, 1968, to September, 1971, studying for Ph.D. at the University of California, U.S.A.; C. A. W. Jackson, Veterinary Research Officer, from September 26, 1969, to February 10, 1971, to undertake post-graduate training at Houghton Poultry Research Station, Great Britain. K. R. Helyar, Research Agronomist, 3 years from September, 1970, at the University of California, U.S.A. on a university assistantship for studies leading towards Ph.D.; I. C. R. Holford, Senior Research Officer, September, 1, 1970, to August 31, 1973, at the Rothamstead Experiment Station, University of London, for studies leading towards Ph.D. following the award of an Australian Wool Board Scholarship; D. R. Leece, Chemist, 3 years from September, 1967, to August, 1970, on a research assistantship at the Michigan State University, U.S.A.; H. Marcellos, Research Officer, from September, 1967, to February, 1971, to study for a Ph.D. at Illinois State University, U.S.A.; J. D. Marshall, Livestock Officer (Sheep and Wool), six months from March 30, 1971, to study methods and techniques in

sheep breeding and wool production in Europe, Canada, U.S.A., Japan and Russia following the award of a "Star" Rural Youth Award sponsored by the Rural Bank of N.S.W.; D. J. McDonald, Research Officer, 3 years from September, 1967, to August, 1970, to visit the Philippines, Japan, Thailand and Mexico and to study at Texas A. & M. University, U.S.A.; B. J. McGuirk, Livestock Research Officer, 3 years from September, 1969, for studies towards Ph.D. at the University of Edinburgh, Scotland; G. M. Murray, Plant Pathologist, 3 years from May, 1971, at the University of Wisconsin, U.S.A. to study towards Ph.D., on an Australian Wool Board Scholarship; R. E. Paull, Research Agronomist, 3 years from March 12, 1970, to January, 1973, to study for Ph.D. at the University of California, U.S.A.; J. G. Ryan, Economist, from September 3, 1968, to September 9, 1971, for study towards Ph.D. at North Carolina State University, U.S.A.; B. R. Wilson, Livestock Research Officer, 3 years from December, 1968, for studies for Ph.D. at the University of Alberta, Canada.

Officers Officially Overseas For Special Purposes

The following professional officers were overseas: B. D. Ament, Chief, Division of Extension Services, from May 1, 1970, to July 2, 1970, to investigate trends in agricultural extension in S. Africa, Netherlands, U.K. Canada, U.S.A. and N.Z.; J. H. Ballard, Special Agronomist, (Seed Production) from February 21, 1970, for two weeks, to undertake Colombo Plan assignments in India; L. D. Beeby, District Livestock Officer (Beef Cattle), from March 6, 1971, to May 14, 1971, to investigate changing technologies and the role of extension in the beef cattle industry in U.S.A. and U.K.; Dr F. C. Butler, Senior Deputy Director-General, from June 23, to July 6, 1970, to attend meetings of the Standing Committee on Agriculture and the Australian Agricultural Council, New Guinea; Wee-Lek Chew, Botanist, from June 16, 1971, to mid-November, 1971, to participate in an expedition organised by the Royal Society, London, to study flora of the New Herbrides Islands. J. L. Cooper, Agronomist (Research), from January 4, 1971, to April 30, 1971, to study wheat production and irrigation techniques in New Zealand on a travel award from the Rural Youth Council; G. A. Crawford, Deputy Chief, Division of Research Stations, from February 22, 1971, for approximately 2 weeks, to advise on further development of the India-Australian Sheep Stud Farm in relation to a lands survey and irrigation layout plan, at Hissar, India; J. J. Dellow, Agronomist, from September 6, 1970, to October 8, 1970, on a Royal Agricultural Society Travelling Scholarship to study agricultural industry and farming methods, in Australia; P. C. Druce, Chief, Division of Marketing and Economics, from June 23, to July 6, 1970, to attend meetings of the Standing Committee on Agriculture and the Australian Agricultural Council in New Guinea; R. D. Eastoe, Principal Livestock Officer (Sheep and Wool) from February 21, 1970, for four weeks, to undertake Colombo Plan assignments in India; P. C. Fahy, Plant Pathologist, from April 11, 1971, to July 7, 1971, to attend the 3rd International Conference on Plant Pathogenic Bacteria in the Netherlands, and to visit U.K., Hungary, U.S.A. and New Zealand; Dr A. R. Jackson, Officer-in-Charge, District Veterinary Laboratory, Armidale, from July 25, 1970, for three months, to give advice in connection with the Indo-Australian Sheep Breeding Centre, India and to visit Iran and Turkey; T. H. Johns, Director, Biological and Chemical Research Institute, from July 5, 1970, to November 11, 1970, to attend the International Codex Committee on Pesticides Residues, U.S.A., U.K., Europe, Italy and Japan; J. F. Johnson, Principal Fruit Officer (Pome Fruits), from August 9, 1970, to November 7, 1970, to study development on pome fruit production in N.Z., Canada, U.S.A., U.K., and Europe; H. C. Kirtton, Deputy Chief Biometrician, from August 15, 1970, to September 9, 1970, to attend the International Biometrical Conference; Germany, U.S.A., England and N.Z.; R. Milburn, Deputy Senior Inspector, from July 8, 1970, to July 19, 1970, to advise on return of vehicles and equipment to Australia in respect of plant quarantine requirements in S. Vietnam; P. J. Mylrea, Officer-in-Charge, District Veterinary Laboratory, Wollongbar, from April 29, 1971, to May 17, 1971, to attend an exotic disease training course, in U.S.A., and Canada; R. D. Pares, Plant Pathologist, from September 14, 1970, to September 28, 1970, to attend an Electron Microscope School, England and Holland; G. Pasfield, Chief Entomologist, from May 10, 1970, to September 10, 1970, to attend the 9th Commonwealth Entomological Conference, Commonwealth Agricultural Bureau Review Conference, Anti-Locust Research Centre Silver Jubilee Conference, London; D. M. Ryan, Livestock Officer, from October 26, 1970, to November 21, 1970, on a Royal Agricultural Society Scholarship to examine the beef cattle industry in New Zealand; G. D. Slennett, Principal Livestock Officer (Poultry) from August 7, 1970, to October 9, 1970, to attend the 14th World Poultry Conference, U.S.A., U.K., and Spain; R. E. Smart, Fruit Officer (Research) from March 14, 1970, to September 17, 1970, on a Public Service Board Fellowship to participate in the XVIIIth International Horticultural Congress, Israel, and to visit France, Britain and U.S.A.; R. R. Storrier, Senior Lecturer, from April 12, 1971, to August 28, 1971, for research into the development and evaluation of methods of measuring inorganic nitrogen in the soil in U.S.A., Canada, England and the Netherlands; F. B. Sugden, Regional Publicity Officer, from July 2, 1970, to August 21, 1970, to attend the Annual Conference of the American Association of Agricultural College Editors, U.S.A.; D. E. Wallin, Principal Agronomist, from February 22, 1971, for two weeks, to advise on the further development of the India-Australian Sheep Stud Farm, at Hissar, India; W. R. Watson, Superintendent, Royal Botanic Gardens, from March 21, 1970, for 3 months 20 days on a Public Service Board Fellowship to investigate developments in botanic gardens in Scotland, G. Britain and the U.S.A.

PERSONNEL SECTION

Induction and Counselling

Interviews and Enquiries. — The number of induction interviews conducted by officers of the Personnel Section declined as a result of the policy of severe limitation on the filling of vacancies and creation of new positions. Interviews and telephone discussions were held with members of the staff in connection with excessive unpunctuality, sick leave, unsatisfactory services and grievances. This part of the section's activities increased compared to last year.

Induction Courses. — An induction course was held for 46 new university trainees early in 1970. A similar half-day induction course in Sydney early in 1971 was attended by 14 new agricultural college trainees.

Employment and Recruitment

Employment Enquiries. — The number of employment interviews and enquiries dealt with by the section increased. The increase may have resulted from the general decline in the employment opportunities available in agriculture. The section continued to provide information and assistance to migrants enquiring about the opportunities for employment.

Careers Exhibition and Careers Nights. — The Personnel section collaborated with other Departments to provide a Public Service Exhibit in Careers Exhibition at Sydney Town Hall in September, 1970. Personnel section officers also gave addresses at careers nights at various Metropolitan high schools.

Staff Assessment, Reporting and Guidance

During the year 602 reports were obtained on the services of officers. These reports were called for in conjunction with payment of increment, confirmation of permanent appointment and review of services, etc.

University and Agricultural College Trainees

The Department had 186 trainees at the various universities and agricultural colleges, involving sixteen degree or diploma courses. Five of the 186 were repeating an academic year at their own expense. There were sixty trainees recruited in 1970.

Accommodation

During the year a number of officers were allocated Government Real Estate cottages. Difficulty has been experienced by some officers in obtaining accommodation in some of the smaller towns, for example, Tumut.

